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L.M.B.C. MEMOIRS
ON TYPICAL BRITISH MARINE PLANTS & ANIMALS

EDITED BY
JAMES JOHNSTONE, D.Sc., & R. J. DANIEL, D.Sc.

XXX.

MANX ALGAE

AN ALGAL SURVEY OF THE SOUTH END
OF THE ISLE OF MAN

BY

MARGERIE KNIGHT, D.Sc.
Lecturer in Botany, University of Liverpool

AND

MARY W. PARKE, B.Sc.
Algologist, Marine Biological Station, Port Erin

(With two maps and 19 Plates)

THE UNIVERSITY PRESS OF LIVERPOOL

DECEMBER, 1931

EDITORS' PREFACE.

THIS Memoir contains the first instalment of the results of a comprehensive survey of the algal flora of the Irish Sea in the neighbourhood of Port Erin, Isle of Man. The programme has been planned so as to include a study of the ecology of the marine algae from this district ; an investigation of their physiological processes as they are to be seen in a few selected species and (later on) an attempt to assess the importance of the littoral and inshore algae in the general problem of the production of organic materials in the sea. It was quite necessary to begin this work with a study of the systematics of the group : Thus the list of Manx algae published in 1913 by Harvey Gibson, Knight, and Coburn contained 99 species fewer than those included in this work and the interesting question rises to whether or not the difference represents an actual secular or variable change, or whether the former lists were merely incomplete. At any rate an exhaustive systematic survey must precede ecological investigation and the work of Dr. Margery Knight and Miss Parke goes far towards providing that material. The results published here represent a great deal of detailed work on life-histories carried out in the last few years by Dr. Knight and her pupils—although this may not be apparent in the bare summaries contained in the Memoir.

It has been thought advisable to present the results of the systematic survey in the form of an "L.M.B.C. Memoir," because the information may fittingly be made available to University students, amateur naturalists and investigators beginning work on marine algae. Many such workers visit the Port Erin Biological Station and it is certain that this book will be of great assistance to them. It is also the hope of the Authors that they may have the collaboration of some of these workers because so much remains to be done—quite apart from ecological and physiological studies—that co-operation by voluntary investigators will be most welcome.

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L.M.B.C. MEMOIRS

No. XXX. MANX ALGAE AN ALGAL SURVEY OF THE SOUTH END OF THE ISLE OF MAN

BY

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AND

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INTRODUCTION

THE present Memoir embodies the results of a systematic survey of the algal flora of the south-east corner of the Isle of Man. The survey has covered a period of some few years and a considerable stretch of coastline has been laid under contribution, from Fleshwick Bay in the west to Castletown on the south-east seaboard. Much of this coastline is too steep to admit of easy access, but wherever possible, the algal flora has been sampled and comparative studies made between point and point.

The area offers considerable variety of algal habitat. Fleshwick Bay (Map II, 1) presents a stony beach flanked by steep cliffs with boulder-fringed base. As a contrast Port Erin Bay (Map II, 4) provides a sandy stretch with emergent rocks, giving origin to a series of rock pools with a rich algal flora. The broken breakwater at the mouth of the Bay also provides the algologist with a profitable hunting ground ; for here, seaward of the tumbled concrete blocks, may be found those genera and species that flourish best in rough water conditions ; while within the shelter of the old boat-landing close by, is a quiet arm of the Bay in which many of the rarer species are to be found, the vertical sides of the concrete blocks offering a specially good collecting ground.

The steep coast lying between Port Erin Bay and the Sound (Map II, 7) is largely inaccessible to exploration from the land except at one or two points such as Bay Fine (Map II, 5) or Aldrick Bay (Map II, 6) where a typical boulder beach with its associated flora may be found. This type of habitat forms an almost continuous strip of varying width round the foot of the cliffs as far as Perwick Bay in the south-east. Here and there the bold thrust of a

headland with precipitous cliffs interrupts the continuity of the boulder beach, and where the land dips down to the Sound the cliffs give way in places to inlets and small bays offering a variety of algal habitats with floras of varied character. Perwick Bay shelters a stone-covered beach, and offers a favourable locality for the study of continuous Furoid vegetation.

From the point of view of the algologist, however, the most interesting piece of coast in the area is that starting from Perwick Bay, passing through Port St. Mary Bay (Map II, 10), Bay ny Carricky (Map II, 11), Pooyllvaaish (Map II, 12) and following the contours of the coast round Scarlet Point (Map II, 13) as far as the entry of the Silver Burn into the sea at Castletown (Map II, 14).

The tilt of the land is such that the cliffs at Castletown give way gradually to an almost flat coastline. The diminishing steepness results in a gradually extending breadth of shore between tide marks. Much of this piece of coast lies on limestone, and is built up of low terraces almost horizontal in places and with synclinal and anticlinal slopes dipping gently seaward. These limestone terraces offer a type of habitat which stands in sharp contrast to the Fucus-covered boulders of the south-west coast. In places the limestone is worn into a series of hummocks separated by shallow saucer-shaped pools. Here is a locality unfavourable to the development of furoid vegetation, but one that provides the student with an excellent opportunity of studying the flora of rock pools, especially the type known, on account of the dominance of *Lithophyllum* and *Corallina*, as "coralline" pools.

The rest of the south-east seaboard is made up of stretches of fissured rock, interrupted by patches of sand or of sand overlaid by stones. The general trend of the coast brings it almost parallel to the direction of the prevailing

winds, thus protecting it from the full force of the worst gales. It is, however, fully exposed to such gales as come up from the south-east, gales whose violence is clearly illustrated by the tons of algal vegetation carted from the Castletown shore in the autumn.

In making the survey careful notes have been kept not only of the species found in the area, but also of the time of occurrence, the zone of distribution and the period of reproduction in each case.

In the present Memoir no attempt has been made to give an ecological account of the vegetation. That is reserved for the future. Some attention has, however, been paid to a tentative enquiry into the factors governing algal migrations from level to level on the shore throughout the year. A full and detailed study of the ecology of the area will be the subject of a later paper. Meantime the immediate object of publication is to provide the student-visitor to the area with a guide that will, it is hoped, facilitate his efforts to make acquaintance with the algal flora and to gather some understanding of its variation from one season to another.

THE AREA

In this section no attempt has been made to give an exhaustive list of the species to be found in each area. Information on the exact distribution of each species is given in the systematic list. These notes are intended to give the student who has had little previous experience directions as to the best part of the area to study, and to suggest the commoner genera and species that he might reasonably be expected to recognise.

PORT ERIN BAY.

Port Erin Bay offers considerable variety of algal habitat. One of the most productive areas lies amongst

the rocks emerging from the sand on the north side of the Bay. Here are developed a series of rock pools that repay careful investigation. It is a difficult matter to give a list of available plants in the pools as they shew a regular procession of genera and species that varies throughout the cycle of the seasons. In the small pools one species may be dominant in March but completely absent at the end of May. The list provided includes species that may be found between February and July.

Seaward of the pool area lies a fringe of Fucoid and Laminarian vegetation which, in late spring and early summer is very productive of interesting genera and species.

The commonest algae obtainable from this area are :—

CHLOROPHYCEAE

Enteromorpha spp.

Ulva spp.

Monostroma spp.

Cladophora spp.

Codium tomentosum (Winter and Spring)

Rhyopsis (on the sides of deep pools usually about 6 inches below the surface).

Urospora isogona.

Chaetomorpha spp.

PHAEOPHYCEAE.

Laminaria saccharina

L. digitata

Fucus spiralis

F. vesiculosus

F. serratus

Ascophyllum nodosum

Pelvetia canaliculata

Desmarestia aculeata (low water level)

D. viridis (deep pools in Spring)

Scytosiphon lomentarius

Asperococcus fistulosus

Sphacelaria cirrhosa

Cladostephus spongiosus

C. verticillatus

Castagnea virescens (Summer only)

Dictyosiphon foeniculaceus (Summer only)

Chordaria flagelliformis (Summer only)

RHODOPHYCEAE

Porphyra umbilicalis
Corallina officinalis
Delesseria spp.
Ceramium spp.
Callithamnion spp.
Polysiphonia spp.
Gelidium corneum
Furcellaria fastigiata
Polyides rotundus
Ahnfeltia plicata
Calliblepharis lanceolata
Griffithsia spp.
Phyllophora spp.

The list quoted above will serve for the whole of the north side of the bay, but the character of the flora changes somewhat where the coast lifts into the steep cliffs of the Bradda (Map II, 2) promontory. In Spaldrick Bay (Map II, 3) where fresh water comes down from the land, patches of *Fucus ceranoides* may be found.

Immediately below the Biological Station the inlet sheltered by the old boat-landing should be studied, as its shore provides a sample of zoned vegetation. A very clear Furoid series can be observed shewing in succession from high water mark downwards:—*Pelvetia canaliculata*, *Fucus spiralis*, *Fucus vesiculosus*, *Ascophyllum nodosum* on the boulders and *Fucus serratus* on the level rocks. Similarly on both sides of the boat-landing and on the broken breakwater itself at low water mark may be seen a Laminaria zone with *L. digitata* above, *Saccorhiza polyschides* in the lower part of the *L. digitata* zone and *L. Cloustoni* below.

In the inlet pool itself at very low spring tides may be found many of the rarer algae, particularly in the crevices between the concrete blocks.

PORT ST. MARY.

The limestone terraces (Plate I) marked on the map as "the Ledges" (Map II, 9) offer an excellent opportunity

ERRATA.

Page 7, lines 7-10. Read as follows :—

- ZONE 1.** Submerged 5% to 25% of the tidal period.
- ZONE 2.** Submerged 25% to 50% of the tidal period.
- ZONE 3.** Submerged 50% to 75% of the tidal period.
- ZONE 4.** Submerged 75% to 95% of the tidal period.

for the study of shallow rock pools. The far-reaching effects of varying proportions of exposure and submergence are revealed by a careful study of the pool flora and of the inter-pool vegetation of this area.

The area may conveniently be divided into four zones, as follows :—

ZONE 1. Exposed 5 % to 25 % of the tidal period.

ZONE 2. Exposed 25 % to 50 % of the tidal period.

ZONE 3. Exposed 50 % to 75 % of the tidal period.

ZONE 4. Exposed 75 % to 95 % to the tidal period.

Increasing length of the period of submergence shews corresponding rise in frequency of occurrence for individuals of a species, and a marked increase in the number of species present.

The commonest species obtainable are :—

ZONE 1 (Plate II).

Enteromorpha intestinalis
Prasiola stipitata
Urospora isogona
Ralfsia verrucosa
Scytosiphon lomentarius
Corallina officinalis
Lithothamnion Lenormandi

ZONE 2 (Plate VI).

Lithothamnion Lenormandi and *Corallina officinalis* (co-dominant)
Ulva latissima
Cladophora spp.
Codium mucronatum
Ceramium rubrum (epiphytic on *Corallina*)
Callithamnion arbuscula (epiphytic on *Corallina*)
Plumaria elegans (epiphytic on *Corallina*)
Rhodomenia palmata (occasional)

In Zones 1 and 2 there is no inter-pool vegetation.

ZONE 3 (Plate III).

From the beginning of Zone 3 downwards towards the sea the inter-pool vegetation becomes increasingly evident. The commonest plants in this area are :—

Fucus serratus and *Laurencia hybrida* (between pools)

POOL VEGETATION.

Lithothamnion Lenormandi (abundant)

Corallina officinalis (abundant)

Laurencia hybrida (abundant)

L. pinnatifida (abundant)

Cladophora rupestris (abundant)

Himanthalia lorea (abundant)

Cladostephus spongiosus (abundant)

Callithamnion arbuscula (abundant)

Codium mucronatum (frequent)

Ulva latissima (frequent)

Rhodomenia palmata (frequent)

Griffithsia flosculosa (frequent)

Leathesia difformis (frequent)

ZONE 4 (Plate IV and V).

The commonest species in this zone are :—

Laminaria digitata (locally dominant)

Himanthalia lorea (locally dominant)

Fucus serratus (locally dominant)

Rhodomenia palmata (locally dominant)

Ceramium rubrum (on *Cladostephus*) (abundant)

C. acanthonotum (abundant)

Gelidium spp. (abundant)

Callithamnion arbuscula (on *Cladostephus* or *Corallina*) (abundant)

Delesseria alata (abundant)

Plumaria elegans (abundant)

Chondrus crispus (abundant)

Laurencia pinnatifida (abundant)

Corallina officinalis (abundant)

Cladophora rupestris (abundant)

Cladostephus spongiosus (abundant)

Rhodochorton Rothii (frequent)

Dasya arbuscula (frequent)

Heterosiphonia plumosa (frequent)

Polysiphonia urceolata (frequent)

P. Brodiaei (frequent)

Laminaria saccharina (frequent)

Ectocarpus spp. (frequent)

Elachista scutulata on *Himanthalia* (frequent)

Sphacelaria cirrhosa (frequent)

Gigartina stellata (frequent)

Delesseria sanguinea (occasional)

Nitophyllum ramosum (occasional)

Halidrys siliquosa (occasional)

Furcellaria fastigiata (occasional)

Scytosiphon lomentarius (occasional)

Lomentaria articulata (occasional)

Chylocladia ovatus (occasional)

The contrast between Zones 3 and 4 lies in the increasing stature and number of individuals of the species present in Zone 4 compared with Zone 3, rather than in any great change in the composition of the flora. In Zone 4 the rock surface in between the pools is well covered by a carpet of vegetation. A striking feature is the dominance of *Himanthalia lorea* with which is an admixture of *Fucus serratus*. The undergrowth is chiefly made up of *Cladophora rupestris*, *Cladostephus spongiosus*, *Chondrus crispus*, *Laurencia pinnatifida*, *Chylocladia* spp. and *Plumaria*. The *Himanthalia* zone passes insensibly into the *Laminaria digitata* zone with a similar undergrowth. This level marks the limit of the littoral zone, but at extremely low tides, especially during quiet weather, the student may have an opportunity of penetrating into the *Laminaria Cloustoni* zone, where a search among the epiphytes clustering on the stems of the large Phaeophyceae will yield samples of many of the more delicate Rhodophyceae which have grown under optimum conditions.

The flora of this area will repay systematic visits at different times of the year as it shews well marked seasonal successions. (See section on Periodicity.) Examination of the flora in the spring or early summer will illustrate the lengths to which epiphytism may be carried as a consequence of successive invasion of plants into the area. One striking feature is the persistence with which *Lithophyllum* and *Corallina* are found as the basal layer in the successive "storeys" of vegetation. They may be completely overlaid and eventually quite hidden by superposed vegetation but a little investigation will reveal them, even though the bases of larger algae may spread over the initial coralline carpet. It would appear that non-coralline algae do not readily attach themselves to the bare limestone surface but it is not yet apparent by what means the *Lithophyllum* and *Corallina* overcome this difficulty.

The rocks fringing the harbour at Port St. Mary do not offer a luxuriant flora. Mud from the inner harbour disturbed by the tide appears to exercise a harmful influence. Nevertheless, a visit to the *Zostera* bed (Map II, 16) in search of epiphytes should be made. The beds can be reached via a flight of steps leading on to the shore from about the middle of the High Street.

FLESHWICK BAY.

This part of the coast does not offer any type of algal vegetation that cannot be studied equally well in other areas, though the freshwater stream entering the bay frequently yields *Batrachospermum*, and patches of *Fucus ceranoides* on the shore owe their existence to the same stream. Amongst the Rhodophyceae to be found here may be mentioned *Catenella repens* which is very common in the crevices of the boulders. Until a few years ago this bay marked the extreme southern limit of distribution for *Odonthalia dentata* which is still to be found in some quantity in the low lying pools, but of late the plant has spread with some rapidity and is now to be found occasionally in all the bays of the survey area.

Fleshwick Bay is an excellent area for examination of cast-up material a day or two after a heavy storm, especially if the wind is from the north or west. The set of the currents round the coast is such as to bring the detached weeds in masses into Fleshwick Bay. Many of the inaccessible algae from the sub-littoral zone are thus made available to the collector. If an opportunity of dredging for algae presents itself, the algologist will be best repaid by turning his attention to the mouth of Fleshwick Bay.

POOYLLVAISH.

The rocky promontory at the northern end of Bay ny Carricky is an extremely good collecting ground for algologists. A rough cart track (Map II, 15), starting

from just beyond the cottage on the Castletown side of the point where the main road leaves the coast, leads directly seawards. It provides an easier means of access to the lower levels of the littoral zone than is afforded by a scramble over a considerable stretch of large boulders covered with *Ascophyllum*. On the right of the cart track as one faces the sea are a series of rock pools with a varied and interesting flora. In the summer time this is an excellent hunting ground for the rarer Rhodophyceae, such as *Monospora pedicellata*, *Griffithsia corallinoides*, *Spondylothamnion multifidum*, *Antithamnion cruciatum*, etc. In many of the deeper pools *Halidrys siliquosa* is well established as a perennial and yields a number of interesting epiphytes of restricted distribution. *Tilopteris Mertensii* and *Stictyosiphon tortilis* have been recorded for this locality alone and have not as yet been found in any other part of the survey area. An opportunity of collecting at the lowest of spring tides, especially in calm weather, or better still with a gentle off-shore breeze, could be employed more profitably in an examination of the low-lying levels of the shore at Pooyllvaaish than in any other part of the district.

CASTLETOWN.

The Castletown beach provides a type of shore in some respects similar to that of Pooyllvaaish. It is an excellent area for general collection in the springtime. The coast enjoys a certain amount of shelter and it has been noticed repeatedly that many of the Rhodophyceae reach greater size and are of more luxuriant habit in the large shallow pools in the *Fucus*-covered littoral zone at Castletown than elsewhere. South-eastward towards Scarlet Point (Map II, 13) the land rises into terraces of limestone carrying an algal flora similar to that already described for Port St. Mary.

THE EFFECT OF ALTERNATING SEASONS ON THE ALGAL VEGETATION

To the casual observer the alternation of winter and summer brings little apparent change in the character of the algal population of the shore. This impression is largely due to the fact that the more obvious algae such as Fucoids and Laminarians are perennial plants. The algologist, nevertheless, is well aware that the number of genera and species represented in the flora is less in winter than in summer, and many of those species that do occur all the year round may be present in smaller numbers and in more restricted localities in the colder months of the year. Hence there is in reality a distinct fluctuation in richness of the flora as the seasons succeed one another, with a well-marked crescendo in the early summer accentuated by the influx of a large body of what have often been described, though sometimes without adequate reason, as "summer annuals."

Speaking generally, the poorest season for marine algae is in November and December. At this time of the year the algal population is at its lowest ebb though this does not necessarily imply that all growth and development is at a standstill. On the contrary, some of the Rhodophyceae (species of *Polysiphonia*, etc.) and certain erratic genera (*Phyllitis*) shew signs of more vigorous growth at this period than at any other. The general algal population, nevertheless, is reduced to its lowest terms as a consequence of partial depopulation of the shore during the autumn—a process brought about either by rough weather or by other inclement physical changes in the environment.

In the early spring, signs of general rejuvenation and re-colonisation of the littoral zone are observable. From February onwards there is a constant stream of new

arrivals first in pools and later on the general surface of the littoral zone as first one and then another member of the summer population makes its re-appearance.

Strictly speaking, in marine plant life, there is no hard and fast line to be drawn between "annuals" and "perennials"; distinct though these conditions may be when applied to land types. Indeed, neither term is applicable in its strictest sense to algal organisms.

Analysis of the data collected over an extended period shews that many algae, of which Fucoids and Laminarians are outstanding examples, are always to be found on the sea-shore. These plants are to be regarded as the nearest approach to perennials that can be found among British marine algae.

Another class of algae comprising many genera is made up of plants that are to be found in profusion over extended areas during the greater part of the year, with a high point of abundance in the early summer. To such a category belong many filamentous Phaeophyceae (*Ectocarpus* spp.) and many Rhodophyceae (*Ceramium* spp.). During the short intervening period representatives of these genera and species are still to be found, though in reduced stature and smaller number, in specially sheltered situations. These plants are therefore present throughout the whole of the year but form a less conspicuous element of the flora in the winter and may even escape observation altogether. Many of these genera and species have been described in older algological treatises as "summer annuals." Clearly they are not truly annual nor yet are they perennial for no individual plant lives for the whole of one season; indeed, its life-span is frequently limited to a few weeks, though the genus is maintained as a permanent component of the algal flora by successions of short-lived individuals. Such plants, whose numbers swell to a maximum in the summer but never quite reach

the vanishing point in winter, are perhaps best described as "pseudo-perennials."

Still another group of plants may be separated out from the rest, a group whose members are present, though not necessarily in abundance, for only a small proportion of the year, perhaps only during May, June and July; and which, despite careful search, are not to be found at all during the other months of the year. It is to such plants that the term "summer annual" may most legitimately be applied; though even here the term is used in a limited sense. This group includes such plants as *Nemalion multifidum*, *Dumontia incrassata*, *Chordaria flagelliformis*, *Mesogloia vermiculata*, etc.

These three groups—the perennial, the pseudo-perennial and the summer annual—contain genera and species with definite stations or zones of distribution to which they remain constant year after year and in which they are to be found in greater or less profusion according to the season.

A fourth group of plants may now be distinguished, whose occurrence is sporadic. These algae occur in small numbers or even as single individuals scattered here and there on the littoral zone. They are evanescent and there is no guarantee that having appeared in a given locality one year they will be found there the following year. Such plants are labelled "rare" in algal catalogues. Their presence in a list for a locality may rest on a single record and many years may elapse before another individual of the species is recorded for the same locality. These species may be described as "casual annuals." Associated with this group are also epiphytes or endophytes which are restricted to specific hosts, but are only of occasional occurrence. Sometimes the host plants show no signs of the dependent plants; at others they are thickly tenanted by the invaders. Such parasites are classed as "sporadic" in the systematic list.

PERENNIALS

Under this heading may be included a number of genera and species whose representatives always form a conspicuous plant-covering to considerable areas of the littoral zone or of the shore below low water mark. This vegetation may remain *in situ* in a given locality year after year. For example, a boulder beach formed of stones too large to be moved easily by the tide will usually bear a covering of one or another species of *Fucus*; while large boulders between tide-marks are constantly draped by *Ascophyllum nodosum*. The *Fucus* or *Ascophyllum* association is itself perennial but such a description can be applied only with reservations to the individual plants forming the association.

Longevity is not a well-marked feature of algal life. The vigour of the individual soon wanes, and it is doubtful whether on British coasts the span of life of even these so-called perennials exceeds two or three years. The permanence of the vegetation in contrast to the impermanence of the individuals is attributable to one or more of several factors:—

- (a) The daily liberation of enormous numbers of reproductive cells extending over a long period (often several months).
- (b) The ease with which the liberated cells attach themselves to the substratum and the readiness with which they germinate.
- (c) The power of proliferation from truncated basal discs or attachment organs of various sorts.

The co-operation of these three factors is sufficient to maintain a constant supply of new plants to take the place of those that disappear.

Perennation in the sea is thus somewhat different from what one understands by perennation on land. Marine algae have no embedded parts, well stocked with

food material and protected by their underground position from the rigours of the unfavourable season. On the contrary, the whole of the plant is at all times exposed to the medium of sea-water and to the influences of physical forces affecting it. Some few algae do indeed inhabit situations where the rock surface is covered by sand or mud ;—for example, *Rhodochorton Rothii*, *Enteromorpha compressa*, etc., but in general the plants derive no special benefit from such a situation : on the contrary, movable sand is apt to imperil rather than safeguard algal life.

Within a marine environment there are always some plants which retain their power of growth throughout the year. On the British coasts, for example, at all times of the year one can find sporelings of *Fucus* in various stages of development scattered over the littoral zone. Many of them have started life in positions where they will never succeed in establishing themselves as mature plants, but the frequency with which one encounters these hardy young plants well outside their normal fucoid zone, indicates the ease with which liberated *Fucus* eggs will germinate, and argues that the alternating climatic conditions of winter and summer on these coasts do not materially affect the growth of Fucoids and other algae indicated in the list of perennials. Tolerance of these plants for a wide range of fluctuation in environmental conditions renders them, as far as growth is concerned, more or less indifferent to the seasons.

This conclusion is supported by the ease with which proliferation from basal parts takes place after removal of the upper part of the frond. One frequently sees evidence of this in the *Fucus* zones. New apices are readily regenerated and new branches produced matching their predecessors in stature and elegance. Nevertheless, this regenerative process is not capable of indefinite repetition. The individual at last loses its vitality and

remains as a decapitated disc, serving only as a locus of attachment for plants of other genera. In the immediate neighbourhood of these relics may be found, in all probability, a flourishing crop of young plants—the progeny of the destroyed parents.

Some genera of the *Fucaceae* show a biennial habit. The young plants make vegetative growth during the first year and defer the formation of conceptacles until the next year. This is the case with *Himanthalia lorea*. In the autumn thousands of minute “buttons” adorn the crevices and irregularities of the rock surface in places where this alga grows (Plate I). Side by side with these infant plants are other “buttons,” one year old and already full grown, from whose centres may be seen sprouting an inch or two of strap-shaped receptacle. Nearby may be found plants of two years’ growth with fully developed receptacles bearing a load of epiphytes whose increasing weight will eventually accelerate the destruction of the *Himanthalia* host.

The simultaneous occurrence of *Himanthalia* buttons of all ages indicates that vegetative growth can be carried on independent of the march of the seasons. The above statement will stand for all algae included in the list of perennials. It must not be supposed, however, that perennial plants are entirely insensitive to the alternation of physical conditions throughout the year. The periodicity of seasonal change is reflected in the production of reproductive organs at one specific season of the year. It is interesting to note that even for allied genera and species the same season is not necessarily selected for reproduction. The *Fucoids*, for example, show among their genera considerable diversity in their times of reproduction. *Ascophyllum nodosum* reproduces from February to May with a high point of fertility in April. *Fucus vesiculosus* follows, beginning in April and rising

to a maximum in May and early June, though fertile individuals may be found much later. August marks the maximum reproductive period for *Pelvetia canaliculata* whose antheridial conceptacles may be so numerous as to paint an orange stripe visible some distance away, round the cliffs at high water mark. *Fucus serratus* prefers the autumn for reproduction and plants with plentiful receptacles may be found throughout the winter.

Clearly there must be for each genus in its appropriate season some co-operative influence of all the effective factors of the environment, stimulating the plant to copious reproduction. • For Fucoids and Laminarians and some other genera, reproductive structures are confined to special limited portions of the thallus : in other cases reproductive organs are produced all over the plant surface. The initiation and nourishment of these cells must tax the resources of the plant to the uttermost so that when large numbers of them filled with food material have been liberated, there is left behind a depleted thallus whose surface, ruptured to allow the escape of generative cells, now offers itself a prey to colonisation by the spores of epiphytic genera. When reproductive cells are liberated in successive crops extending over a long period of time, it is obvious that the expenditure of energy involved and the amount of accumulated material dissipated must eventually bring about complete depletion of the plant's vitality and lower its resistance to the forces tending to destroy it. Of the latter, the most effective is undoubtedly the strain of moving water, and when, as frequently happens, periods of rough weather coincide with the period of maximum reproductive activity, the result is the tearing of thalli and their removal on a wholesale scale.

The fact that depopulation is quickly made good by an upgrowth of sporelings or by proliferation from basal

parts indicates that for many genera there is nothing inhibitive to growth in the conditions governing any season of the year. But new growths require a certain time to attain maturity, hence there is observable a seasonal fluctuation in mass, attributable not to any direct effect of the environment on growth, but indirectly to the precipitation of reproduction on a large scale at one specific season of the year.

All that has been said above about large algae such as Fucoids and Laminarians applies equally well to a host of smaller genera. Such plants as *Laurencia hybrida*, *L. pinnatifida*, and species of *Chondrus*, *Gelidium*, *Gigartina* and *Rhodomenia* have a wide range of distribution on the shore and come under the category of "common" algae. In the autumn these plants are considerably depleted in numbers or suffer decapitation and are represented in the early winter months by their basal parts only, sometimes reduced to a small disc less than a third of an inch in diameter. This relic is firmly adherent to the substratum and is capable of sprouting vigorously into new shoots in early spring. An illustration may be drawn from the behaviour of *Laurencia hybrida* on limpet shells in pools on the limestone terraces at Port St. Mary. In the autumn, this area is subject to a considerable amount of scour, when many of the *Laurencia* fronds are removed. In January an examination of the limpet shells in this area revealed the presence of numerous bases of *Laurencia* plants hidden amongst a covering of *Sphacelaria cirrhosa* (short, tufted, winter form). In February these basal discs had already begun to proliferate from the margins and showed a new growth of fronds nearly an inch long and already bearing antheridia.

If definition of the term perennial implies merely a capacity for withstanding an unfavourable season, then these *Laurencia* plants are perennial. This, however,

is not quite the end of the matter. It is not known, for example, what proportion of the plants remain as persistent bases ; nor how many times this regenerative process may take place in the life of one individual. Young sporelings are constantly developing alongside their mature relatives and are ready to fill in the gaps. It is difficult therefore to estimate with precision the length of life of one plant.

Moreover, the matter is somewhat complicated by the fact that many genera show not one but two periods a year when new thalli arise ; one in the early spring and a second in the autumn. The spring plants reach a reproductive stage in the early summer and may then become submerged under a profuse development of other genera. They persist as somewhat debilitated plants for a time and then die off or remain only as basal attachment organs. Meanwhile the autumn crop of vigorously growing plants—probably the progeny of the spring crop—becomes conspicuous in September and October. Some may reach a reproductive stage but the plants developing late in the season may fail to do so, and remain in a vegetative condition over the winter. The renewal of activity of these plants and the development of sporelings are together responsible for the next spring crop.

PSEUDO-PERENNIALS

It is somewhat difficult to draw a distinction between this class and the preceding one, for if the proportion of persistent bases falls to a low figure, continuity of the species in the flora is maintained largely by the upgrowth of young sporelings and the plants cannot be classed as perennials : neither are they truly annuals but for convenience have been called “pseudo-perennials.” Under this heading have been included a number of species with a peculiar behaviour. The power of regeneration of

new thalli from persistent bases has already been remarked ; there exists also the possibility of regeneration from small detached portions of fronds—fragments of small size but still endowed with sufficient vitality and vigour to enable them to re-attach themselves to the substratum and produce a whole new thallus. In the autumn large masses of plants become torn from their hold and pounded into fragments, many of which remain alive for days, and during their diurnal pilgrimage with the tide up and down the shore, may eventually find harbourage in quiet water or lodgment on tiny crevices, on the surface of shells or become entangled among the thalli of more resistant algae. The relics very soon put out attachment organs, anchor themselves to the substratum and so begin a new phase of existence in a locality perhaps far removed from that in which their first youth was spent. Regeneration from floating fragments thus plays a part, though perhaps a minor one, in maintaining continuity of algal vegetation on the shore. It has been observed that genera and species employing this method most successfully are those whose attachment organs take the form of rhizoidal outgrowths from superficial cells. Among such plants are many of the common species of *Polysiphonia*, *Ceramium* and *Callithamnion*.

A remarkable illustration of the points just raised is provided by the study of the "limpet island" flora of the limestone flats of Port St. Mary. Here saucer-shaped pools varying in depth from a few inches to a foot or two carry a fairly rich summer vegetation. Underlying the plant community is a carpet of *Lithophyllum Lenormandi* (Plate III) which forms in the upper pools a conspicuous covering not unlike a very thick and somewhat lumpy coat of pinkish white enamel. Round the edges of this floor covering and wherever the substratum or the *Lithophyllum* surface gives ready anchorage arise tufts of a very stunted

form of *Corallina officinalis*. These plants in their turn provide a locus for the attachment of a host of other genera (Plate VII). As week succeeds week new arrivals attach themselves to the plants already present until in the summer the strata of epiphytes may be five deep. During the winter the population of these pools suffers great denudation. Everything is removed except the broken and stunted remains of the *Corallina*; even the surface of the *Lithophyllum* looks as if it has been planed down to a minimum basal layer. Limpets in these pools stand up as minute conical islands and suffer denudation less severely than the surrounding plane surfaces. Microscopic examination shows that the limpet shells are covered by the basal remains of a large number of plants and that there are also small fragments of thalli of various genera; these have put out rhizoidal attachments and anchored themselves in the interstices of the shells. During the depth of the winter when nothing may be showing in the upper pools except debilitated *Lithophyllum* and *Corallina*, the limpet islands may still bear a comparatively varied though not luxuriant flora. It is noticeable that the genera found in such situations are all plants provided with a spongy or fibrous system of attachment organs; just the type that can most easily attach itself to the ridges and furrows of the limpet shells. Microscopic investigation of the limpets also reveals numerous minute sporelings in various stages of development, representing genera and species not in evidence in the pool flora except on the limpet shells. These genera and species may, however, be found lurking in pools at deep water level or as stunted plants in sheltered situations. The limpet island flora therefore represents relics of an autumn migration that sets seaward at the onset of unfavourable conditions. Development of this relic flora takes place early in the

year. In February and early March the pools about the half-tide zone may be still in the denuded winter condition but tufts of vigorously growing algae crown the heads of the limpet shells. These now serve as centres of distribution bringing about the rapid recolonisation of the pools in the early summer.

ANNUALS

Under this heading are included genera with a restricted vegetative period or those that appear sporadically ; the distribution of which varies markedly from summer to summer. These plants disappear completely at the end of the favourable season and cannot be accounted for by the persistence of fragments or of plant bases. Their re-appearance must be brought about by the liberation and subsequent germination of propagative cells of one sort or another. These plants are more strictly annual than any discussed above.

In the absence of thick-walled resting spores (not produced by marine algae except perhaps by marine *Vaucherias*) it is difficult to conceive of a delicate unprotected unicell suffering the buffeting of the tides for five or six months and remaining capable of settling down, attaching itself to the rock and reappearing in recognisable form in the same locality where its predecessors had flourished. It must be a *sine qua non* that the reproductive cell attaches itself to the substratum very shortly after its release. The question to be answered is, therefore, to what extent does it develop in the autumn and in what form does it exist over the unfavourable period ? An undeveloped spore or even a plantlet of two or three cells would have little chance of survival against the depredations of browsing crustacea whose habit is to clean up any surface over which they progress. It seems more probable that the spores released in the autumn develop

into minute cellular plantlets large enough to be resistant to forces tending to destroy them, possibly sheltered in tiny crevices of the rock, and ready with the return of Spring to develop into macroscopic plants.

Just as in land plants there may be several crops of annuals in one growing season, if the life-cycles can be achieved in sufficiently short space of time, so, in the sea, the annual summer vegetation may really consist of large numbers of successive generations, rising to maturity and capable of reproduction in a very short space of time. In the autumn, germination of released zoids takes place more and more slowly until finally the growth of the germling is so slow as to be quite imperceptible and the plantlet rests in a condition of protracted infancy until the following spring.

Large numbers of filamentous forms and even genera of more ambitious organisation behave in this way. This method of existing through an unfavourable period is characteristic of summer Rhodophyceae, such as species of *Nitophyllum*, *Bonnemaisonia*, *Callithamnion*, etc., and of many Cladophorae and other Chlorophyceae. The Phaeophyceae behave in a somewhat different manner and will be dealt with in a later section of the memoir.

The constancy of these annuals in the flora is due to the fact that they produce propagative cells in large numbers ; the latter are sown broadcast over the littoral zone and on the substratum below low tide level and, being hardy, germinate in large numbers. Many of the plantlets are doomed to failure but those in an appropriate environment will readily replace their parents in the next summer population.

CASUAL ANNUALS

Casual annuals are only distinguished from "annuals" by the fact that they rarely occur. They are for the

most part species that have strayed from their geographical area of distribution and, finding conditions generally somewhat unfavourable, are not successful in establishing themselves as constant components of the flora. The reproductive cells, though often produced, may find germination exceedingly difficult ; hence it is only an odd individual that succeeds in surmounting the rigours of the winter and reaching maturity in the following summer. *Stilophora rhizodes* will serve as an example. Naturally a member of a more southerly flora it is represented in the British flora of the South Coast and has been recorded for stations all round the coast of the British Isles, including the extreme North, but the Isle of Man record for the plant refers only to Port Erin, and as far as we are aware no specimen has been found during the last eighteen years.

One of the striking features brought out by a study of periodicity among marine algae is the readiness with which reproduction occurs. In the early spring it is quite common to find specimens of *Polysiphonia*, *Ceramium* or *Callithamnion* bearing antheridia or tetraspores on thalli that are barely half-an-inch long. Later in the spring, vegetative growth is carried still further before reproductive cells are formed, so that sterile plants two or three inches or even longer may be found. At the height of the growing season the limits of size achieved before reproduction takes place are still further extended. The co-existence, side by side, of fertile and sterile plants, argues that the formation of reproductive cells is not necessarily a direct result of the physical factors of the environment but is associated in some obscure way with internal factors ; the net result of the combined internal and external forces being the precipitation of reproductive processes as the culmination of the plants' activities,

following a period of vegetative growth, greater or less according to the period of the year.

As the vegetative period is extended the total mass of thalli of plants of one species naturally increases, so that when reproduction does occur it results in an increasing number of propagative cells at every successive crop. The proportion of the latter achieving successful germination also rises with the advancing season, thus accounting for the marked influx and sometimes overwhelming mass development of individuals of a given species in a particular area. The high point of this crescendo movement may be sharply defined. The beaches may be strewn in autumn with hundreds of plants of certain annual species, each in full reproduction, especially if a protracted period of rough weather supervenes in the early autumn. Within the space of a fortnight individuals of the species in question may almost entirely disappear. The change in physical conditions culminating in the autumn thus not only suddenly exercises a deleterious effect on mature thalli but also markedly retards the germination of sporelings which thus remain dormant until the following spring. Such is the behaviour of most annuals.

On the other hand, for some species, autumn conditions may be gentle in their operation so that a gradual diminuendo period follows that of maximum development. As the autumn weeks succeed one another, individuals of a given species occur less and less frequently; they are smaller and smaller in stature and may not readily achieve reproduction. Even during the winter, however, individuals here and there may still persist in sheltered places and small fragments may readily re-attach themselves. These characteristics most usually distinguish the pseudo-perennial. Thus the characteristics distinguishing the perennial, the pseudo-perennial and the annual algae are

seen to be differences of degree rather than of kind. Segregation of species into different categories is based on the following criteria :—

(a) The extent of thallus destruction in the autumn.

1. Thallus only partially removed. Reproduction by sporelings and proliferation from basal parts of plants equally effective in producing new plants. *Perennials.*
2. Thallus almost completely removed. Majority of new plants due to development of sporelings but proliferation from basal parts or from re-attached fragments also common. *Pseudo-perennials.*
3. Thallus entirely destroyed. New plants due entirely to the development of sporelings. *Annuals.*

(b) The extent of the growing period.

1. All the year through. *Perennials.*
2. The major portion of the year. *Pseudo-perennials.*
3. A restricted period in summer (or winter). *Annuals.*

ALGAL MIGRATIONS IN THE LITTORAL ZONE

From what has been said above it is clear that the algal population of the British coasts shows a certain periodic amplification and diminution corresponding to the alternation of summer and winter seasons. The direct effect of seasonal changes is felt less by perennials than by other classes of algae but rough water may be destructive of perennials, pseudo-perennials and annuals alike so that during the late summer numbers of plants may be detached and cast up. Autumn is frequently rendered conspicuous by the enormous masses of weed

lining the beaches. The cause of this wholesale destruction is not a simple one. A good many factors co-operate to bring it about. In large measure it is the penalty of success. Competition for foothold is a great factor in algal life, and when rock surfaces are already occupied to full capacity, new comers must find room on the surfaces of previously established thalli. A second influx of germinating sporelings adds another storey to the superstructure and so on, the stability of the whole resting on the tenacity of the ground-floor tenant, so to speak. The original vegetation is eventually buried under an increasing load of epiphytes and, deprived of necessary illumination, possibly also of adequate oxygen supply, it becomes merely a question of time before the increasing leverage of moving water acting on a deteriorating thallus with a burden of supernumerary organisms proves too much for the elasticity of the plant tissues. Large quantities of detached weed are then thrown up on the shore and find a useful end as manure, contributing their mineral content to the furtherance of plant life on land.

It would seem therefore that part at least of the autumn depopulation is attributable to keen competition for foothold on a limited area of the shore and to mutual interference of the components of a too profuse flora. Nevertheless, the foundation of this annual rise and fall of algal vegetation rests on the difference in physical factors between one season and another.

THE FACTORS

Fig. 1 is a graphic presentation of the mutual relations of mean monthly sea and air temperatures. It is based on the record of temperature data collected during twenty-five years, from 1903-1927, at the Marine Biological Station, Port Erin. Scrutiny of the figure shows that

mean temperatures for air are less than those for the sea during the period from September to March, but exceed them during the summer months. There are thus two points—early April and late August, when mean temperatures for sea and air are approximately equal.

Temperature variation is, however, by no means the most potent factor controlling algal activities. It is difficult to dissociate the influence of rising temperature and of increasing insolation, for as a rule both factors show variation in the same direction at the same time. In the spring, however, when the rate of algal growth undergoes sudden acceleration it is probable that the rising value of incident light involving increased length of daylight as well as of greater intensity of illumination, acts as the stimulating factor, for a scrutiny of temperature records (Fig. 1) shows that no very great rise in the temperature of the sea-water takes place until late in the spring, long after the growth acceleration has shown itself. The somewhat higher air temperatures in the late spring do not play any great part in encouraging algal activity since the most marked growth appears in the lower third of the littoral zone, amongst algae that are not exposed for long periods to the air. On the other hand, rising air temperatures of high summer acting on algae during periods of long exposure or affecting the temperature of pools at high levels on the shore, may reach a point that exceeds the range of toleration of many species inhabiting the littoral zone. Co-operating with this rise in temperature are increased exposure to illumination, enhanced risk of dessication, and increase in the salinity and in the pH of the pools, during the periods when exposure occurs in the middle of the day.

From the data collected one would suspect that temperature and insolation together are limiting factors in the summer time. With these factors must also be considered

the diminution of available nitrates and phosphates in sea-water which, as Atkins, Harvey and others (Publications from the Marine Laboratory, Plymouth) have shown, takes place progressively in the autumn. But the supply of nitrogen is soon replenished by the decay of organic material, especially following the fall in plankton

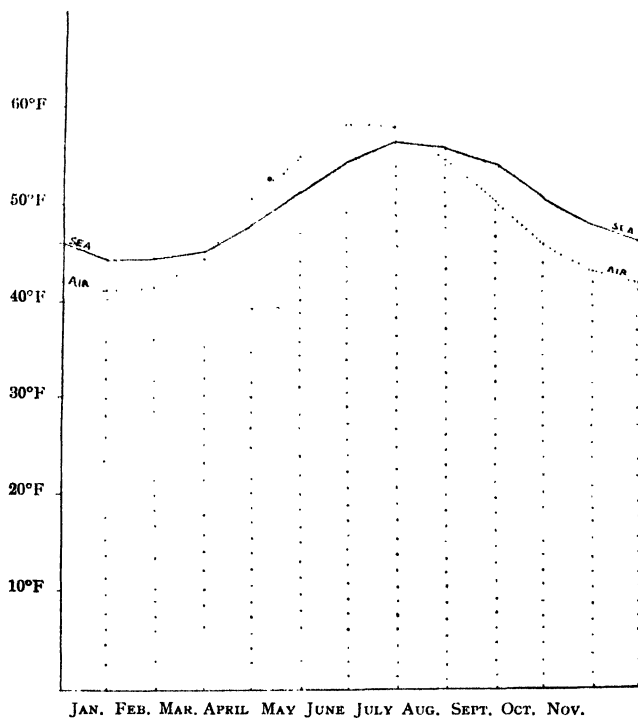


FIG. 1. Mean Monthly Temperatures of Sea and Air for 1903-1927.

content in the autumn, and also by the upwelling of supplies from deeper water. The scarcity of available food supply, therefore, may intensify the unfavourable physical conditions of the autumn and prove the last straw to the resistance of thalli already impoverished by other causes, though it is unlikely that this factor has a prolonged

influence on the vegetation in the winter. It is much more probable that the controlling factors in this season are the varying effects of light and temperature. From the foregoing it is clear that many factors play a part in controlling the algal population of the shore. It would appear that rising temperature and brighter light at first encourage algal growth, provided that adequate nutrient salts and dissolved gases are available, but the limits of variation in an upward direction for both temperature and insolation are soon reached. This is proved by the fact that in more southerly latitudes the grand period of algal growth falls earlier and earlier in the year, until in the Mediterranean region optimum conditions for algal growth occur in the winter and early spring, while summer forms a "dead season."

Periodic observations have shown that during the autumn, individuals of certain species with a wide bathymetric range tend to disappear from the upper levels of their area of distribution, but may be found in quantity in lower levels where they were formerly not so prevalent. This downward migration may be continued until in the height of the unfavourable season individuals of the species in question may still be found in sheltered places in the low-lying levels of the shore but are absent, at all events in macroscopic form, from the middle and upper zones. Dredging or examination of the "cast-ups" after a sudden storm will reveal the presence of these deep water survivors.

The explanation of this "migration" may lie in the fact that physical conditions of upper pools, offering as they do a greater amplitude of variation when compared with the pools at lower levels, automatically become unsuitable habitats for the development of a given species. Released spores will therefore either fail to germinate or will grow only into a microscopic winter form

and the species "disappears" from the flora of the upper pools, though it may still be flourishing in pools further down the shore. Later on adverse conditions may affect successively deeper lying pools, so bringing about what appears to be a "migration." In the following spring the procession of macroscopic plants follows the reverse order and appears to rise from level to level as spring merges into summer.

Many species of Rhodophyceae (*Rhodomela subfusca*, *Delesseria* sp.) and some Chlorophyceae undergo this seaward migration in the winter. The pools about high water of neap tides are characteristically green in summer. Many of them are inhabited exclusively by species of *Enteromorpha*, *Ulva*, *Cladophora*, *Rhizoclonium* and *Chaetomorpha*. During the winter this well-marked zone is almost obliterated and representatives of the genera in question are to be found at much lower levels—in the mid-tide area for example. The behaviour of *Cladophora rupestris* may be most marked; in September it forms, on the limestone terraces of Port St. Mary, a well-marked zone several yards in depth at a distance of 50 yards (representing a drop in level of 12 feet) from high water of neap tides. Observation of this zone in January shows that the plants are worn down to their bases or completely removed and the well-marked zone of September was scarcely detectable, though large numbers of plants actively growing and already reproducing were to be found further down the shore nearer to low water mark. The zooids from the plants in this area are doubtless responsible, together with proliferation from basal remains, for the re-establishment of the mid-tide *Cladophora rupestris* zone in the early summer.

The direction of these migrations is not always as outlined above, for there are many species whose movements are in exactly the opposite direction. They are

to be found in lower pools in the summer and gradually spread upwards during the winter to form a conspicuous component of pools at much higher levels. The behaviour of *Dumontia incrassata* or of *Scytosiphon lomentarius* will illustrate the point—the latter being a well-marked component of the littoral zone. In the summer months it achieves optimum development about the mid-tide zone. The most luxuriant specimens die away towards the end of September but small individuals often without characteristic constrictions make their appearance at or near high tide mark and may be found there in large numbers, often without admixture of other algae, long after their fellows have quite disappeared from the lower levels of the shore. For some time these winter plants remain sterile, but in January and February they shew renewed activity of growth and reproduction and act as a source of "infection" of all neighbouring pools. The successive generations now work downwards from the upper part of the shore towards low water level; at the same time the plants become successively larger and more luxuriant; they also reproduce readily. As the summer advances the upper pools become uninhabitable and the *Scytosiphon* plants die out from these levels during the months of July and August but re-appear in the autumn. There is thus, so to speak, a seasonal tide of *Scytosiphon* plants moving rhythmically from higher to lower levels of the shore and back again in the span of one year. This migratory habit of *Scytosiphon lomentarius* is shared by other genera present in the flora throughout the whole year but appearing in different parts of the shore in different seasons. A comparative study of the flora of the limestone terraces of Port St. Mary at different times of the year has shown that many Rhodophyceae, especially species of *Polysiphonia*, *Ceramium*, *Callithamnion* move upwards during the winter. In January

the upper limit of their distribution may be 30 yards higher up the shore than in September, corresponding to a rise of 8 feet in a vertical direction.

Migrations such as have been described above also take place in pools if the volume and depth of the pool be sufficiently large. The following observations were made on the movements of *Asperococcus fistulosus* in a large pool on the shore at Port Erin. The pool in question lies rather high up on the shore but is about five feet deep at the seaward end where it is also protected by upstanding rock ridges from too great insolation. Landward it shallows markedly, its depth decreasing to a few inches. The sides are for the most part vertical and though the pool is distinctly above the zone of red seaweeds on the surrounding shore, many members of the Rhodophyceae find suitable habitats on its shaded sides. The total length of the pool is ten feet and its breadth five, offering an excellent opportunity for observation of periodic changes in the algal flora. *Asperococcus fistulosus* plants are to be found in January and February only in the well-lighted shallow end of the pool where they appear to take advantage of the best illuminated positions. The plants are small, slender and show only occasionally the irregularity of outline typical of normal plants. They are usually provided with plurilocular sporangia only and are now regarded as the winter form of *A. fistulosus*, though at one time it was suspected that they might be a distinct species or at least a variety. The view now held is that they merely represent a seasonal growth form of the plant. In March these plants show no great increase in number and appear to be less flourishing than formerly though other and more robust plants—presumably the progeny of the first-comers—now make their appearance in a position about half-way between the shallow and the deep ends of the pool. These latter

plants do not grow at the surface but appear as epiphytes on other algae growing on the sides of the pool at a depth of about a foot. One gains the impression that the factors controlling conditions at the shallow end of the pool are no longer favourable to the growth of *Asperococcus fistulosus*. Still later in the year, during the summer months, the plants disappear from the median position and are only to be found near the bottom of the pool at the deep end, where illumination is diminished and where the temperature is less subject to daily rise by insolation. This localised movement of *Asperococcus* within the confines of one pool is paralleled by the movements of the plants on the open shore. In the winter *Asperococcus fistulosus* is to be found only as meagre individuals in shallow well-lit pools of the upper zone. It relinquishes this position in the spring and appears as a component of the flora of pools much lower down the shore where the shorter period of daily exposure counteracts the increasingly strong spring sunshine. The downward migration is continued until *Asperococcus* is to be found as an inhabitant of pools lying at the level of ordinary neap tides.

The factors determining these migrations are difficult of analysis. It would appear that a falling value for light intensity is not the imperative factor for plants that move downwards during the winter since a move in such direction leads to further diminution of the already reduced autumn and winter daylight. Neither is scarcity of mineral salts likely to cause migration since the work of Harvey, Atkins, and others has shown that the nitrate and phosphate content of sea-water though depleted in the autumn is replenished in the winter. The factor that suggests itself as being directly concerned with these migrations is that of changing temperatures. In the summer the air temperature rises above that of the sea,

consequently pools left longest exposed to the air will reach a higher temperature than others. Conversely the air temperature in the winter falls distinctly below that of the sea, so that the upper pools will again be the ones to show the greatest range of variation. There is therefore a graduated scale of temperature observable on any sector of the shore with the highest values in pools at the high tide level and a minimum value, equivalent to that of the general sea temperature, in pools at low water mark. The intervening pools will shew intermediate temperatures determined partly by their distance from the low water mark and partly by the physical proportions of the pools themselves—shallow pools being subject to greater temperature rise than deep pools during the same period of insolation. Moreover, a deep pool may shew well-marked layering of water at different temperatures. The upper surface under the influence of insolation may rise in temperature but, if no mixing of the waters from below occurs, the warmer and therefore lighter water will remain floating on top. A difference of three degrees between surface water and bottom water may be observed in summer in a pool that is no more than eighteen inches deep.

In the winter the temperature gradient may be reversed in direction. The lowest temperature will be experienced by the algal flora of the upper pools. It follows therefore that spring and autumn constitute critical periods for the algae, literally turning points in the current of invasion. In an interesting way this temperature factor serves to discriminate genera and species according to their preference for certain conditions and determines the direction of their seasonal migrations from level to level on the shore. Plants with a preference for warmer conditions will move down the shore in the winter and re-ascend to higher levels in the following spring.

The movements of algae *up* the shore in the winter are probably accounted for by the diminished light of the autumn and winter. Many Rhodophyceae are among the plants that migrate in this manner and being somewhat sensitive to the strength of illumination falling on them can only spread upwards during the period of diminished insolation. In the spring the rising values of the incident light act as a limiting factor to the upward movement and the high values of summer insolation may actually cause the death of plants in the upper levels of their area of distribution. Another factor may also take a prominent part in the summer zoning of the algae, namely the change in pH of the pools subject to great insolation. The pools at the upper limits of the tidal zone with an exclusively green algal population frequently show pH values as high as 9.6. Such conditions encourage the growth of Chlorophyceae but prove unsuitable habitats for the growth of Phaeophyceae and still more so for Rhodophyceae.

It has been shown that periodicity in algal activity is controlled by the physical factors consequent on life in a moving medium and also by physiological changes in other factors of the environment. The factor that limits the advance of a genus is not necessarily also a limiting factor for other genera or even for other species of the same genus. Nor is the proportionate influence of component factors the same for all plants; nor is it constant for one plant at all times of the year. Whatever be the relations between an alga and the component factors which together make up its environment, the onset of unfavourable conditions is inevitably heralded by copious reproduction; the last act of the threatened vegetation is the production of propagative cells, just as the formation and maturation of seed marks the finale in the annual life-cycle of the land plant.

THE SYSTEMATIC LIST

The systematic list of algae has been compiled during the past ten years by periodic collection from five points in the south-west corner of the Island, namely :—Port Erin, Port St. Mary, Fleshwick, Castletown, and Pooyllvaaish. The nomenclature and system of classification here adopted is that established by Batters (1902) in his "Catalogue of the British Marine Algae," but where the author of the catalogue has made alteration in a name long familiar to algologists, the older name is introduced in brackets. In certain instances Batters' naming of a species has been revised by Mr. A. D. Cotton (1912) in his report on marine algae in the Clare Island Survey. The revised names have been adopted here.

The present list is in part an amplification of several previous lists, to which has been added a considerable body of new data accumulated during the past few years by various workers who have visited the station from time to time, and by the authors themselves who have collected regularly throughout several years over the five collecting grounds.

The only comparatively recent list of the algae of the Island is one compiled by Harvey-Gibson, Knight and Coburn (1913) and published in the "Transactions of the Liverpool Biological Society." The list in question includes the names of all algae found by the authors themselves or occurring in the scientific papers of previous collectors (Bradley, 1861; Garner, 1867; Gatty, 1872; King, 1889; Marrat, 1863-4; Talbot, 1890). Where species have been recorded but not seen by the authors the authority for the record is given in brackets. The present authors have adopted the same policy.

Since the publication of the 1913 list the recorded number of species in the algal flora of the Island (exclusive

of blue-green algae and Diatoms) has risen to 349,—a number that exceeds the 1913 census by 99. The new species are indicated in the following list :—

NEW SPECIES ADDED SINCE 1913.

CHLOROPHYCEAE

- Prasiola stipitata* Suhr.
- Capsosiphon aureolus* Gobi.
- Codiolum gregarium* Br.
- C. petrocelidis* Kuck.
- Pringsheimia scutata* Rke.
- Monostroma Grevillei* Wittr. var. *Cornucopiae* Batt.
- Monostroma Wiltrockii* Born.
- Enteromorpha torta* Reinb.
- E. micrococca* Kütz.
- Ullothrix implexa* Kütz.
- Endoderma viride* Lagerh.
- Endoderma flustrae* Batt. var. *Phillipsii* Batt.
- Urospora collabens* Holm. et Batt.
- Chaetomorpha crassa* Kütz.
- Rhizoclonium Kernerii* var. *endozoica* Wille.
- Cladophora fracta* Kütz. var. *flavescens* Batt.
- Gomontia polyrrhiza* Born. et Flah.
- G. manxiana* Chodat.
- Vaucheria Thuretii* Woron.
- Codium amphibium* Moore.
- C. adhaerens* Ag.

PHAEOPHYCEAE

- Mikrosyphar Polysiphoniae* Kuck.
- Litosiphon filiformis* Batt.
- Stictyosiphon subarticulatus* Hauck.
- S. tortilis* Rke.
- Punctaria plantaginica* Grev.
- Asperococcus bullosus* Lamour.
- A. compressus* Griff.
- Streblonema fasciculatum* Thur.
- S. infestans* Batt.
- S. Zanardinii* Batt.
- Ectocarpus parasiticus* Sauv.
- E. brevis* Sauv.
- E. luteolus* Sauv.
- E. microscopicus* Batt.
- E. tomentosoides* Farlow.
- E. velutinus* Kütz.
- E. simplex* Crn.
- E. ovatus* Kjellm. var. *arachnoides* Rke.
- E. confervoides* Le Jol forma *typica* Kjellm.
- E. fasciculatus* Harv. var. *refracta* Ardissonne.

E. fasciculatus Harv. var. *Draparnaldioides* Crn.
Arthrocladia villosa Duby.
Myriactis pulvinata Kütz.
Elachista flaccida Aresch.
Leptonema fasciculatum Rke, var. *majus* Rke.
Colpomenia sinuosa Derb. et Sol.
Sphacelaria bipinnata Sauv.
Haloeteris filicina Kütz, var. *sertularia* (Bonnem.)
Myrionema accidioides Sauv.
Myrionema saxicola Kuck.
Myrionema strangulans Grev. var. *punctiforme* Holm. et Batt.
Ulonema rhizophorum Foslie.
Hecatonema maculans Sauv.
Ascocyclus saccharinae Cott.
Lithoderma fatiscens Aresch.
Chordaria divaricata Ag.
Aglaozonia reptans Crn.
Dictyota dichotoma Lamour, var. *implexa* J. Ag.

RHODOPHYCEAE

Erythropeltis discigera Schm. var. *flustrae* Batt.
Erythrocladia subintegra Rosenv.
Porphyra coccinea J. Ag.
P. linearis Grev.
Colaconema reticulatum Batt.
Acrochaetium endozoicum Batt.
A. emergens Rosenv.
Helminthora divaricata J. Ag.
Scinaia furcellata Bivona.
Choreocolax Polysiphoniae Reinsch.
Harveyella mirabilis Schm. et Rke.
Pterocladia capillacea Born.
Gelidium pusillum Le Jol.
G. pulchellum Kütz.
G. latifolium Born.
Sterrocolax decipiens Schm. (see note 15)
Rhodymenia palmata Grev. var. *marginifera* Harv.
Nitophyllum uncinatum J. Ag.
Nitophyllum ramosum Batt. var. *uncinatum* Grev.
Polysiphonia spinulosa Grev. var. *major* J. Ag.
Trailliella intricata Batt.
Ptilothamnion pluma Thur.
Halurus equisetifolius Kütz.
H. equisetifolius Kütz. var. *simplicifolium* J. Ag.
Callithamnion scopulorum Ag.
Callithamnion Dudresnayi Crn.
Callithamnion Brodiaei Harv.
Monospora pedicellata Sol.
Antithamnion cruciatum Näg.
A. plumula Thur.
Ceramium strictum Harv.

Ceramium botryocarpum Griff.
Dudresnaya verticillata Le Jol.
Melobesia farinosa Lamour.
Melobesia corallinae Solm.
M. minutula Foslie.
Lithophyllum incrustans Foslie.
Lithothamnion colliculosum Fosl., var. *rosea* Batt.
L. lichenoides Fosl. var. *agariciformis* Fosl.
Corallina squamata Ellis.

It will be seen that the new records include a number of microscopic species whose absence from previous lists is no doubt due to lack of critical microscopical examination. Many of these species are endophytes or epiphytes of minute stature ; some were previously regarded as the reproductive phases of the hosts on which they live and only recently have been raised to the dignity of independent genera.

The macroscopic additions are not without interest. The inclusion of some new names in the list is doubtless due to the fact that new areas have been laid under contribution. *Monospora pedicellata* for example, is locally abundant at Pooyllvaaish, but has not been recorded elsewhere in the Island. It is probable that as the field of operations is gradually extended to include all the small bays that indent the coast, the names of other locally restricted species may be added to the list.

This explanation does not, however, suffice for all the newcomers. It is believed that there have been real additions to the flora of the Island. A few years ago, *Colpomenia sinuosa* made its appearance on the Castletown coast (see Cotton, 1908, 1911). It was then represented only by occasional individuals ; but within the space of five years, it has spread so widely that it is now a common component of the summer flora in the littoral zone in four of the collecting areas.

Other plants whose frequency on the shore has shown marked increase of late are *Calliblepharis lanceolata*, *Halurus*

equisetifolius, *Pterosiphonia thuyoides* and several species of *Ectocarpus*. The influx of these algae does not appear to be merely a phase of frequency-variation, controlled by physical conditions in any one season, whereby the plants may be common in one year and only of occasional occurrence in the next ; rather does it represent a steady forward movement continued over at least ten years, by which the area of distribution is widened and at the same time the frequency of occurrence within the area is raised.

The question naturally arises as to why floristic variations of this type should occur. Scrutiny of the newly-added names shows that the majority of the larger forms are plants occurring commonly at points widely distributed on the British coasts. The Isle of Man is therefore well within their area of distribution. Its insular position may have delayed the appearance of these species on its coasts ; but as soon as chance immigration occurs, it is only a matter of time before the species in question become well-established components of the Manx flora.

Standing as it does midway between north and south of the British Isles, the Isle of Man occupies the border-line between northern and southern floras, with the result that such northern plants as *Odonthalia dentata* and *Euthora cristata* exist side by side with typical southern forms such as *Spondylothamnion multifidum*. Many of the newcomers such as *Asperococcus bullosus*, *Ectocarpus luteolus*, *Nitophyllum uncinatum* and *Trailliella intricata* have a definite maximum occurrence on southern coasts. These species are therefore on the northern fringe of their area of distribution. Similarly, species such as *Stictyosiphon subarticulatus* and *S. tortilis* belong to higher latitudes and have moved southwards. The Isle of Man therefore is a meeting ground for migrants from both northern and southern floras. The greatest influx of

newcomers has been from the south. This fact might indicate an amelioration of physical conditions during the past twenty years ; but, unfortunately for the theory, it has been observed that about an equal number of species, also of more southerly distribution, seem to have disappeared from the flora during the same period. Comparison of the present records from the Port Erin Station with the lists of older collectors for Douglas Bay shows that about twenty species with definitely southern distribution are missing from the south-west corner of the Island. It is of course conceivable that they are inhabitants of the sub-littoral zone and inaccessible to the collector. The most careful search has been made of the collecting area and the conclusion reached that either the Douglas Bay records were of plants detached from their hold in deep water and cast up by the tide, or that the species have actually disappeared from the flora, for they are not now to be found despite assiduous search even in their original localities. The outstanding species under discussion are :

Cystoseira ericoides
C. discors
C. fibrosa
Phyllophora palmettooides
Gymnogongrus Griffithsiae
G. Norvegicus
Nilophyllum Gmelini
Dasya ocellata
Seirospora Griffithsiana
Compsothamnion thuyoides
Ceramium fastigiatum
C. circinnatum
Gloiosiphonia capillaris

Owing to some obscure factor of the environment these species have not retained their place in the flora of the Island, but in view of the fact that the general trend of immigration appears to be from the south, it is possible that they will reappear sooner or later when ocean currents

or the movements of birds, or some other agent of distribution, brings about a re-colonisation of the Manx coast.

When compared with other areas the algal flora of the Isle of Man is not strikingly rich. Despite its border-line position between northern and southern floras, the Island does not wholly share either flora since the plants of restricted distribution in both are missing. It is difficult to account for some of the absences even on the view expressed above ; for example, *Spyridia filamentosa* and *Bostrychia scorpioides*, though frequent in the Menai Straits, have not yet been recorded for the Island. Nor does the Island flora show the richness characteristic of the Irish coast about the same latitude. Compared with the list of algae published in the Clare Island Survey, the Isle of Man records can show only 343 species and varieties against the 424 (exclusive of blue-green) of the Irish coast. The major portion of the algal flora therefore consists of species which it shares in common with the rest of the British Isles.

In compiling the systematic list an endeavour has been made to indicate, for the benefit of the student, where an illustration of each species may be found, by reference to literature which the student will be able to consult in the library of the Biological Station. Most of the references are to the "Phycologia Britannica," which is indicated in the text merely as "Harvey." The numerals in the reference refer to the volume and to the synoptic number of the species. It is frankly admitted that many of the illustrations referred to are not fully adequate ; an attempt has been made to supply deficiencies by the inclusion of original drawings, but the expense involved in providing satisfactory illustration for all the species is prohibitive for this publication.

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CHLOROPHYCEAE

Sub-Order. *PROTOCOCCINAE*.

Fam. *CHARACIACEAE*.

Gen. **Codiolum**, A.Br.

C. gregarium, A. Br. Rare.

Fig. : Plate XV, 48, 53.

District : Port Erin.

Zone : H.W.O.S.T.

Occurrence : Casual, Annual, Summer.

Reproduction : July and August.

C. Petrocelidis, Kuck. Rare.

Fig. : Kuckuck (1894-6), Vol. I, p. 259.

District : Port Erin.

Zone : M.T. to H.W.O.N.T.

Occurrence : Casual, Annual, Summer.

Reproduction : Summer.

Notes : Found in *Petrocelis cruenta*.

Sub-Order. *CONFEROIDEAE*.

Fam. *BLASTOSPOREAE*.

Gen. **Prasiola**, Ag.

P. stipitata, Suhr. Locally abundant (see note I, p. 105).

Fig. : Plate XVI, 59.

District : Port Erin; Peel; The Chasms; Port St. Mary.

Zone : H.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : Common throughout year.

Notes : Found under rocks inhabited by sea-birds.

Fam. *ULVACEAE*.

Gen. **Pringsheimia**, Rke.

P. scutata, Rke. Not uncommon.

Fig. : Oltmanns I, p. 301.

District : Port Erin; Port St. Mary; Fleshwick; Castletown.

Zone : No definite zone.

Occurrence : Sporadic, same as host.

Reproduction : All times.

Notes : Epiphytic on many algae, e.g. : *Polysiphonia*, *Ceramium*, etc.

Gen. **Monostroma**, Thur.

a EUMONOSTROMA

M. Wittrockii, Born.

Fig. : Hauck, Meeresalgen, p. 423.

District : Port Erin ; Port St. Mary ; Pooyllvaaisl.

Zone : M.T. zone in pools.

Occurrence : Annual, Spring and Summer.

Reproduction : Spring and Summer.

b ULVARIA

M. Grevillei, Wittr. Common.Fig. : Harvey IV, 341 (as *Ulva lactuca* Linn.)

District : Common in all districts.

Zone : M.T. pools to H.W.O.N.T.

Occurrence : Annual, Spring and Summer.

Reproduction : Most marked in August.

M. Grevillei, Wittr., var. *Cornucopiac*, Batt. Uncommon.Fig. : Harvey IV, 330 [as *Enteromorpha cornucopiac*]

District : Port Erin ; Port St. Mary.

Zone : M.T. pools.

Occurrence : Spring and Summer.

Reproduction : Spring and Summer.

Notes : Generally epiphytic on *Corallina officinalis*. This appears to be the young stage of *Monostroma Grevillei*.Gen. **Capsosiphon**, Gobi.*C. aureolus*, Gobi.Fig. : Hauck, Meeresalgen, p. 434 [as *Enteromorpha aureola* (Ag.) Kütz.]

District : Port Erin ; Chasms.

Zone : H.W.O.S.T.

Occurrence : Casual.

Reproduction : Frequent.

Notes : Mixed with *Prasiola stipitata* and *Enteromorpha micrococca* on the concrete at the end of Port Erin Promenade, just above the broken breakwater.Gen. **Percursaria**, Bory.*P. percursa*, Rosenv. Uncommon.

Fig. : Plate XV, 55, 56.

District : Port Erin ; Port St. Mary ; Peel.

Zone : M.T. to H.W.O.N.T.

Occurrence : Pseudo-perennial.

Reproduction : At all times of year.

Notes : Found occasionally in quiet pools on the shore in the summer, but frequent in lobster tanks at Biological Station during winter.

Gen. *Enteromorpha*, Link.

E. clathrata, J. Ag. *a genuina*, Batt. Common.

Fig.: Harvey IV, 335.

District: Port Erin; Port St. Mary; Castletown; Peel.

Zone: H.W.O.N.T. in Summer; M.T. zone in Winter.

Occurrence: Pseudo-perennial; maximum development in Summer

Reproduction: At all times of the year.

E. paradoxa, Kütz, var. *typica*, Batt.

Fig.: Harvey IV, 334 [as *Enteromorpha erecta*].

Notes: Recorded by R. J. Harvey-Gibson. No data available.

E. Ralfsii, Harv. Occasional.

Fig.: Harvey IV, 339.

District: Port Erin; Port St. Mary.

Zone: M.T. zone.

Occurrence: Summer, Annual.

Reproduction: Summer.

E. torta, Reinb. Frequent.

Fig.: Harvey IV, 338 [as *Enteromorpha percursea*].

District: Port Erin; Port St. Mary.

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Summer, Annual.

Reproduction: Summer.

E. ramulosa, Hook, var. *robusta*, Hauck. Locally abundant.

Fig.: Harvey IV, 336.

District: Port Erin; Port St. Mary.

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Annual, Spring and Summer.

Reproduction: Summer.

Notes: Most frequent in pools on gently sloping shores.

E. compressa, Grev. Common.

Fig.: Harvey IV, 332.

District: Common everywhere.

Zone: H.W.O.S.T. to M.T. zone.

Occurrence: Pseudo-perennial; but maximum development in early summer.

Reproduction: At all times of the year. Copious in August; surface of pools green with escaping zooids.

Notes: Most luxuriant where fresh water streams present.

E. Linza, J. Ag., var. *lanceolata* (Kütz). Frequent.

Fig.: Harvey IV, 342.

District: Port Erin; Port St. Mary; Castletown.

Zone: All zones.

Occurrence: Pseudo-perennial.

Reproduction: Summer.

Notes: Frequent in Port Erin Bay in July where fresh water flows down the sand at north end of Bay; also frequent in deep pools on Port St. Mary shore in April, May, and June.

E. intestinalis, Link. Locally abundant.

Fig. : Harvey IV, 331.

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaaish.

Zone : H.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : At all times, maximum in Summer.

Notes : Found in high brackish pools at Pooyllvaaish and Port St.

Mary. Very large specimens obtained from estuary of river at Castletown.

E. micrococca, Kütz, var. *tortuosa*, J. Ag. Locally abundant.

Fig. : Plate XV, 49, 50, 52.

District : Port Erin , The Chasms.

Zone : H.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : At all times of the year.

Notes : Found mixed with *Prasiola stipitata*

Gen. *Ulva*, L.

U. lactuca, L. var. *latissima*, D.C. Abundant.

Fig. : Harvey IV, 340 [as *U. latissima*].

District : Abundant everywhere.

Zone : Occurs in all zones.

Occurrence : Pseudo-perennial, maximum development in Summer.

Reproduction : At all times of the year, maximum sporing in July and August.

Notes : Very abundant on Port Erin shore, where fresh water present. Diminishes in September, leaving shore white with depleted plants. More common in M.T. zone in winter, but migrates to upper zone in Summer.

Fam. *ULOTHRIXACEAE*.

Gen. *Ulothrix*, Kütz.

U. implexa, Kütz.

Fig. : Harvey IV, 370 [as *Lyngbya Cutleri*].

District : Port Erin.

Occurrence : Sporadic.

Reproduction : Usually reproductive whenever found.

Notes : Found on the sides of the fish tanks at Biological Station.

U. flacca, Thur. Not uncommon.

Fig. : Harvey IV, 369 [as *Lyngbya flacca*].

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaaish.

Zone : L.W.O.N.T.

Occurrence : Annual, Summer.

Reproduction : Summer.

Notes : Generally found in brackish pools near high water zone.

Fam. *CHAETOPHORACEAE*.Gen. *Blastophysa*, Rke.*B. rhizopus*, Rke. Occasional.

Fig.: Oltmanns I, p. 264.

District: Port Erin; Port St. Mary.

Zone: All zones.

Occurrence: Sporadic.

Reproduction: At all times of the year.

Notes: Parasitic in *Ulva lactuca*.Gen. *Endoderma*, Lagerh.*E. viride* Lagerh. Frequent.Fig.: Hauck, p. 463 [as *Entocladia viridis*].

District: Port Erin; Port St. Mary.

Zone: All zones according to host.

Occurrence: Sporadic.

Reproduction: Whenever found.

Notes: Found as endophyte in the walls of many Rhodophyceae,
e.g. *Ceramium rubrum*.*E. Wittrockii*, Wille. Frequent.Fig.: Hauck, p. 463 [as *Entocladia Wittrockii*].

District: Port Erin; Port St. Mary.

Zone: All zones according to host.

Occurrence: Sporadic.

Reproduction: At all times of the year.

Notes: Found as endophyte in many *Phaeophyceae*.*E. flustrae*, Batt. Rare.

Fig.: Plate XV, 54.

District: Port Erin.

Occurrence: Casual, Summer.

Notes: Found in *Flustra* species; dredged or cast ashore.*E. flustrae*, Batt, var. *Phillipsii*, Batt. Occasional.

Fig.: Plate XV, 51.

District: Port Erin.

Zone: L.W.O.N.T.

Occurrence: Sporadic.

Reproduction: April, possibly at other times too.

Notes: Parasitic in *Alcyonidium hirsutum*, attached to species of
Delesseria.Fam. *CLADOPHORACEAE*.Gen. *Urospora*, Aresch.*U. isogona*, Batt. Common (= *U. mirabilis* Aresch, as quoted by Cotton
in Clare Island Survey).

Fig.: Plate XIV, 42, 47.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaish.

Zone: H.W.O.S.T. to M.T. zone.

Occurrence: Pseudo-perennial.

Reproduction: Zoospores and gametes together in Autumn but zoospores precede gametes in Spring.

Notes: Always occurs higher up the shore than *U. bangioides* and attains maximum growth during Winter and Spring months.

U. bangioides, Holm and Batt. Locally frequent.

Fig.: Plate XVI, 46.

District: Port Erin.

Zone: L.W.O.N.T. to L.W.O.S.T.

Occurrence: Pseudo-perennial.

Reproduction: Asexual reproduction by zoospores in Winter, sexual reproduction in Spring.

Notes: Only been found at low water covering large stretches of rock; is not able to stand long exposures to the air.

U. collabens, Holm and Batt. Rare.

Fig.: Plate XIV, 41.

District: Port St. Mary.

Zone: H.W.O.N.T.

Occurrence: No data.

Reproduction: No data.

Notes: Found mixed with *Urospora isogona*.

Gen. *Chaetomorpha*, Kütz.

Occurring separately or together as components of flora in top pools. Frequently in pools that are inhabited exclusively by *Chlorophyceae*, that is, pools in which the hydrogen ion concentration rises high during Summer.

C. tortuosa, Kütz. Frequent.

Fig.: Harvey IV, 321 [as *Conserva tortuosa*].

District: Port Erin; Port St. Mary; Castletown; Pooyllvaish; Douglas Bay.

Zone: H.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: No data.

Notes: Forms tangled skeins loosely tangled round other algae, e.g., Corallina. May become conspicuous in early summer at Port St. Mary.

C. litorea, Cook. Not common.

Fig.: Harvey IV, 318 [as *Conserva litorea*].

District: Port Erin; Douglas Bay (Talbot).

Zone: L.W.O.N.T.

Occurrence: No data. Single record for February.

Reproduction: No data.

Notes: Few threads only have been found. These were entangled in *Sphacelaria cirrhosa*. Cotton regards this species as a slender form of *Chaetomorpha linum*. Since our specimen had the occasional swollen cells characteristic of *C. litorea* as illustrated in Harvey, we have retained it under this name.

C. linum, Kütz. Frequent.Fig. : Harvey IV, 320 [as *Conferva sutoria* Berk.]

District : Port Erin ; Port St. Mary.

Zone : H.W.O.S.T.

Occurrence : Summer, Annual.

Reproduction : No data.

Notes : Filaments deep green, tangled in masses generally in brackish pools at high-water mark.

C. acreea, Kütz. Frequent.Fig. : Harvey IV, 324 [as *Conferva acreea*].

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot).

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Pseudo-perennial.

Reproduction : At all times of the year.

Notes : Forms tangled ropes up to a foot long in pools on upper part of shore.

C. melagonium, Kütz. Frequent.Fig. : Harvey IV, 323 [as *Conferva melagonium*].

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot) ; Clay Head (Brady).

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Pseudo-perennial.

Reproduction : At all times of the year ; maximum in Spring.

Notes : Occurs as isolated threads in lower half of littoral zone in Winter, but develops in tufts in upper half in Summer.

C. crassa Kütz. Frequent.Fig. : Harvey IV, 319 [as *Conferva linum* Roth.]

District : Castletown ; Poollvaish.

Zone : M.T.

Occurrence : Annual, Spring and Summer.

Reproduction : Whenever found.

Gen. *Rhizoclonium*, Kütz.*R. riparium*, Harv. Frequent.

Fig. : Harvey IV, 314.

District : Port Erin ; Port St. Mary.

Zone : H.W.O.N.T.

Occurrence : Pseudo-perennial. Maximum development in Spring and Summer.

Reproduction : At all times of the year.

Notes : Distinguished by fine hook-like branches.

R. Kernerii, var. *endozoica* Wille.

Fig. : Plate XIX, 77.

District : Port Erin ; Port St. Mary ; Castletown.

Zone : Wherever host may be found.

Occurrence : Sporadic.

Notes : In the tissues of *Halichondria panicea*.

Gen. *Cladophora*, Kütz.*C. pellucida*, Kütz. Frequent

Fig. : Harvey IV, 291.

District : Frequent in all districts.

Zone : M.T. to L.W.O.N.T.

Occurrence : Pseudo-perennial.

Reproduction : Spring onwards.

Notes : Often find *Schmitziella endophloea* as parasite in the *C. pellucida*.

Usually inhabits deep pools in lower half of littoral zone.

Frequent in Summer, but reduced to basal parts of plant in Winter.

C. Hutchinsiae, Harv. Frequent.

Fig. : Harvey IV, 294.

District : Port St. Mary ; Castletown ; Pooyllvaish ; Douglas Bay (Gatty).

Zone : L.W.O.N.T.

Occurrence : Pseudo-perennial.

Reproduction : July to September.

Notes : One of the most distinguished and luxuriant of *Cladophora* spp.

Reduced to basal parts in Winter.

C. rupestris, Kütz. Abundant.

Fig. : Harvey IV, 297.

District : Common everywhere.

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Pseudo-perennial.

Reproduction : Common during Spring and Summer. Maximum in March.

Notes : In Spring and Summer forms an almost continuous carpet in middle and lower littoral zone ; can be found as relics on limpet shells or on rock surfaces amongst other algae in Winter. Numerous sporelings recognisable in January.

C. rupestris, Kütz, var. *nuda*, Holm and Batt.Fig. : Harvey IV, 296 [as *C. nuda*].

District : Port Erin ; Port St. Mary.

No other data available. Recorded by R. J. Harvey-Gibson.

C. utriculosa, Kütz. Frequent.Fig. : Harvey IV, 298 [as *C. lætevirens*].

District : In all districts.

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Annual.

Reproduction : Spring and Summer.

Notes : Common component of pool flora in spring and summer in middle third of littoral zone on gently sloping shores, extending downwards to low water. Plants conspicuous, bright green, three to four inches long.

C. gracilis, Kütz. Uncommon.

Fig.: Harvey IV, 300.

District: Port Erin; Port St. Mary; Douglas Bay (Talbot).

Zone: L.W.O.S.T.

Occurrence: Annual.

Reproduction: No data.

Notes: Deep water form only obtained at low water of spring tides in summer.

C. flexuosa, Harv. Rare.

Fig.: Harvey IV, 299.

District: Port Erin.

Zone: L.W.O.S.T.

Occurrence: Annual, Summer.

Reproduction: Summer.

Notes: Generally occurs in deep pools at low water and below.

C. albida, Kütz. Not uncommon.

Fig.: Harvey IV, 304.

District: Port St. Mary; Douglas Bay (Mrs. Gatty).

Zone: M.T. zone and below.

Occurrence: Annual, Summer.

Reproduction: Summer.

Notes: Occurs on rocks and in pools.

C. albida, Kütz, var. *refracta*, Thur. Not common.

Fig.: Harvey IV, 303 [as *C. refracta*].

District: Port Erin; Douglas Bay (Brady).

Zone: L.W.O.S.T.

Occurrence: Annual, Summer.

Reproduction: No data.

Notes: In pools and on rocks at low water of Spring tides.

C. fracta, Kütz, var. *marina*, Hauck.

Fig.: Harvey IV, 313.

District: Port Erin.

No other data available. Recorded by R. J. Harvey-Gibson.

C. fracta, Kütz, var. *flavescens*, Batt. Not common.

Fig.: Harvey IV, 312 [as *C. flavescens*].

District: Port Erin; Pooyllvaish.

Zone: H.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: Frequent all the year, maximum in Spring.

Notes: In stagnant pools in upper third of littoral zone.

C. arcta, Kütz. Frequent, common locally.

Fig.: Harvey IV, 307.

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Talbot).

Zone: All zones.

Occurrence: Perennial.

Reproduction: Spores March to September.

Notes: Forms an almost complete carpet near low water mark on the limestone ledges at Castletown; also occurs in pools in all zones up to high water mark.

C. uncialis, Kütz.

Fig. : Harvey IV, 306.

District : Douglas Bay.

Recorded by Talbot in his list as *C. lanosa*, var. *uncialis*, Thur.*C. lanosa*, Kütz. Frequent.

Fig : Harvey IV, 305

District : In all districts

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Summer, Annual.

Reproduction : Summer.

Notes : Same habitat as *C. utriculosa*. Epiphytic : forms delicate, almost spherical tufts three-quarters to one and a half inches in diameter on such algae as *Furcellaria*.

Fam. GOMONTIACEAE.

Gen. Gomontia, Born. et Flah.

G. polyrhiza, Born. et Flah.

Fig. : Oltmanns III, p. 474.

District : Port St. Mary.

Notes : Only a single record on whelk shell.

G. manxiana, Chodat.

No data. Recorded in Batter's list.

District : Castletown.

Fam. BRYOPSIDACEAE.

Gen. Bryopsis, Lamour.

B. hypnoides, Lamour. Not common.

Fig. : Harvey IV, 285.

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot).

Zone : M.T. zone downwards.

Occurrence : Pseudo-perennial.

Reproduction : June.

Notes : Generally found in deep sheltered pools in lower third of littoral zone ; most frequent in Spring.

B. plumosa, Ag. Frequent.

Fig. : Harvey IV, 284.

District : In all districts.

Zone : M.T. zone.

Occurrence : Perennial.

Reproduction : In June and July.

Notes : Most plentiful in March to July in pools in the mid-tide zone. Commonly found under overhanging ledges in pools. Small and scattered plants can be found in deep pools in Winter.

Fam. *VAUCHERIACEAE*.Gen. *Vaucheria*, D.C.*V. Thuretii*, Woron.Fig. : Harvey IV, 288 [as *Vaucheria velutina*].

District : Port Erin ; Port St. Mary.

Zone : M.T. zone.

Notes : Scraped from the surface of limpets. No other data available.

Fam. *SPONGODIACEAE*.Gen. *Codium*, Stackh.*C. adhaerens*, Ag. Very rare.

Fig. : Harvey IV, 281.

District : Port St. Mary.

Zone : M.T. zone.

Occurrence : Perennial.

Reproduction : No data.

Notes : Found in one locality only ; patch about 2 ft. square in area.

C. amphibium, Moore. Very rare.

Fig. : Harvey IV, 282.

District : Perwick Bay ; Port St. Mary.

Notes : Has not been observed by authors ; recorded in Batters' list.

C. tomentosum, Stackh. Frequent.

Fig. : Harvey IV, 283.

District : In all districts.

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Perennial.

Reproduction : Winter and early Spring.

Notes : *C. tomentosum* generally occurs in deep pools, reaching maximum size in the Winter.*C. mucronatum*, var. *atlanticum*, Cott. Frequent.

Fig. : Cotton, 1912.

District : Port Erin ; Port St. Mary.

Zone : M.T. zone.

Occurrence : Pseudo-perennial or perennial.

Reproduction : Summer.

Notes : In pools.

PHAEOPHYCEAE.

Sub-Order. PHAEOSPOREAE.

Fam. *DESMARESTIACEAE*.Gen. *Desmarestia*, Lamour.*D. viridis*, Lamour. Frequent.

Fig. : Harvey I, 19.

District : In all districts.

Zone : L.W.O.S.T. in deep pools.

Occurrence : Annual.

Reproduction : Summer.

D. aculeata, Lamour. Common.

Fig. : Harvey I, 18.

District : In all districts.

Zone : Below L.W.O.S.T.

Occurrence : Perennial.

Reproduction : No data.

Notes : This species only obtained by dredging. Abundant September to November. Winter form maintained until March.

D. ligulata, Lamour. Rare.

Fig. : Harvey I, 17.

District : Port Erin ; Port St. Mary ; Castletown ; Peel.

Zone : L.W.O.N.T. and below.

Occurrence : Annual, Spring and Summer.

Reproduction : No data.

Notes : Appears to be a deep water form, but young plants, 2 ins. long, were found at L.W.O.N.T. mark in February on the Port St. Mary ledges. Old plants frequently cast up in the Summer.

Fam. *DICTYOSIPHONACEAE*.Gen. *Dictyosiphon*, Grev.*D. foeniculaceus*, Grev. Common.

Fig. : Harvey I, 41.

District : In all districts.

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia, Summer.

Notes : Very common on gently sloping shores such as Castletown, nearly filling the pools at mid-tide zone. In July forms a conspicuous band round the foot of the rocks on the northern end of Port Erin beach. In September and October nearly always epiphytic on *Chordaria flagelliformis*.Fam. *PUNCTARIACEAE*.Gen. *Mikrosyphar*, Kuck.*M. Polysiphoniae*, Kuck. (See Note 2, p. 105.)

Fig. : Oltmanns III, p. 463.

District : Port St. Mary.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in February.

Notes : Endophytic in walls of *Polysiphonia urceolata* ; has also been observed in *Ceramium Deslongschampsii* and *Callithamnion arbuscula*.

Gen. *Litosiphon*, Harv.*L. pusillus*, Harv. Frequent.

Fig. : Harvey I, 49.

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot).

Zone : Same habitat as *Chorda filum*.

Occurrence : Annual, Summer.

Reproduction : Unilocular and plurilocular sporangia in July.

Notes : Generally found growing on *Chorda filum*.*L. Laminariac*, Harv. Frequent.

Fig. : Harvey I, 50.

District : Port Erin ; Port St. Mary ; Castletown.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Plurilocular sporangia in June.

Notes : Found on the thalli of *Alaria*, etc., in Summer.*L. filiformis*, Batt. Frequent.Fig. : Oltmanns II, fig. 345 [as *Pogotrichum filiforme*].

District : Port Erin ; Port St. Mary.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Annual, Spring and Summer.

Reproduction : Plurilocular sporangia in March.

Notes : Generally found epiphytic on the fronds of *Laminaria digitata*.Gen. *Phloeospora*, Aresch. emend. Rke.*P. brachiata*, Born. Frequent.

Fig. : Kuckuck (1929), p. 83.

District : Port Erin ; Port St. Mary.

Zone : L.W.O.N.T.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia in May and June. Plurilocular sporangia or both types in July, August, and September.

Notes : Frequent in certain localities. Generally found on *Rhodymenia palmata*. It disappears in September with most of the *Rhodymenia*, reappearing in May. Winter form unknown.Gen. *Stictyosiphon*, Kütz.*S. subarticulatus*, Hauck. Occasional.

Fig. : None available.

District : Port Erin ; Port St. Mary.

Zone : M.T. zone to L.W.O.N.T. in pools.

Occurrence : Annual, Summer.

Reproduction : No data.

S. tortilis, Rke. Locally frequent.

Fig. : Plate XIII, 38.

District : Pooyllvaish.

Zone : M.T. zone.

Occurrence : Annual, Spring and Summer.

Reproduction : Unilocular sporangia in April and May.

Notes : Common on the sandy shore at Pooyllvaish ; grows in patches.

Gen. **Striaria**, Grev.*S. attenuata*, Grev.

Fig. : Harvey I, 42.

District : Port Erin.

Notes : Single record. Cast up in Summer bearing unilocular sporangia.

Gen. **Punctaria**, Grev.*P. plantaginea*, Grev. Frequent.

Fig. : Harvey I, 44.

District : Port Erin ; Port St. Mary ; Castletown.

Zone : M.T. zone to L.W.O.N.T. in pools.

Occurrence : Pseudo-perennial, maximum in Spring.

Reproduction : Unilocular and plurilocular sporangia from April to July.

Notes : First appears as small plants on the limpets in January ; attains maximum size in early Summer, disappearing in August.

P. latifolia, Grev., var. *genuina*, Batt. Not common.

Fig. : Harvey I, 43.

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay (Talbot).

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Annual, Summer.

Reproduction : Unilocular and plurilocular sporangia in Spring.

Notes : Generally occurs in shallow pools on gently sloping shores and on protected ledges.

P. tenuissima, Grev. Not common.

Fig. : Harvey I, 45.

District : Port Erin ; Port St. Mary ; Douglas Bay (Brady).

Zone : M.T. zone and below.

Occurrence : Summer, Annual.

Reproduction : Summer ; unilocular sporangia appearing at the end of May.

Notes : Generally found epiphytic on *Chorda filum*.Fam. **SCYTOSIPHONACEAE**.Gen. **Phyllitis**, Kütz.*P. zosterifolia*, Rke. Rare.

Fig. : None available.

District : Port Erin ; Port St. Mary ; Perwick Bay.

Notes : Recorded by R. J. Harvey-Gibson. No data available.

P. fascia, Kütz, var. *genuina*, Batt. Frequent.Fig. : Harvey I, 29 [as *Laminaria fascia*].

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay (Talbot).

Zone : M.T. zone.

Occurrence : Pseudo-perennial, maximum occurrence in Winter.

Reproduction : Plurilocular sporangia January to March.

Notes : Appears in the mid-tide pools early in November ; disappears beginning of April ; probably migrates to deeper water during Spring and Summer. Common in certain localities.

Gen. *Scytosiphon*, Ag.

S. lomentarius, J.Ag. Common.

Fig. : Harvey I, 31 [as *Chorda lomentaria*].

District : In all districts.

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Pseudo-perennial.

Reproduction : Plurilocular sporangia from November to March.

Notes : See page 33.

S. lomentarius, J.Ag., var. *zostericola*, Thur. Not common.

Fig. : None available.

District : Port St. Mary ; Castletown ; Derby Haven.

Zone : L.W.O.S.T.

Notes : Found on the leaves of *Zostera*.

Fam. *HYDROCLATHRACEAE*.

Gen. *Colpomenia*, Derb. et Sol.

C. sinuosa, Derb. et Sol. Common.

Fig. : Oltmanns II, p. 64.

District : In all districts.

Zone : H.W.O.N.T. to L.W.O.N.T.

Occurrence : Pseudo-perennial.

Reproduction : Plurilocular sporangia in Summer ; unilocular sporangia unknown.

Fam. *ASPEROCOCCACEAE*.

Gen. *Asperococcus*, Lamour.

A. fistulosus, Hooker (see Note 3, p. 105). Common.

Fig. : Harvey I, 48 [as *A. echinatus*].

District : In all districts.

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Pseudo-perennial.

Reproduction : In Autumn, unilocular and plurilocular sporangia on the same plants ; in Winter unilocular sporangia numerous ; in Spring unilocular and plurilocular sporangia on separate plants.

Notes : In Winter small specimens of *A. fistulosus* may be found in the high tide zone, but during the Summer they are present only in the M.T. zone.

A. bullosus, Lamour. Frequent.

Fig. : Harvey I, 47 [as *A. Turneri*].

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaish.

Zone : M.T. zone to L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia in Summer.

A. compressus, Griff.

Fig. : Harvey I, 46.

Notes : Single record. Cast ashore at Pooyllvaish. No other data available.

Gen. *Streblonema*, Derb. et Sol.

S. fasciculatum, Thur. Not uncommon.

Fig. : Hauck, p. 323.

District : Port Erin ; Port St. Mary ; Castletown.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in July and August.

Notes : Immersed amongst the cortical filaments of *Castagnea virescens*. Disappears in Winter because the *Castagnea* is absent ; may be present in Winter as an epiphyte elsewhere but has not yet been located.

S. infestans, Batt. Rare.

Fig. : Plate XIX, 78.

District : Port Erin.

Zone : Same as host, generally near low water mark.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in April.

Notes : Endozoic in *Alcyonidium hirsutum*, on *Delesseria* species.

S. Zanardinii, Batt. Rare.

Fig. : Plate XII, 28, 32.

District : Port St. Mary ; Castletown.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in April and May.

Notes : Found immersed in the cortical layer of *Chylocladia kaliformis*.

Gen. *Ectocarpus*, Lyngb.

E. parasiticus, Sauv. Very rare.

Fig. : Oltmanns III, p. 469. Plate XIII, 33, 37.

District : Port Erin.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in March.

Notes : Parasitic in the thallus of *Cystoclonium purpureum*.

E. brevis, Sauv. Rare.

Fig. : Plate XIX, 79.

District : Port Erin.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in Summer.

Notes : Parasitic in the thallus of *Ascophyllum nodosum*.

E. luteolus, Sauv. Not uncommon.

Fig. : Plate XI, 19, 20, 24.

District : Port Erin.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in July.

Notes : Parasitic in the thallus of *Fucus vesiculosus*.

E. microscopicus, Batt. Rare.

Fig. : Olthmanns II, p. 25 [as *Cylindrocarpus microscopicus*].

District : Port Erin.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in April.

Notes : Parasitic in *Plumaria elegans*.

E. tomentosoides, Farlow. Common.

Fig. : Plate VIII, 1.

District : Port Erin ; Port St. Mary.

Zone : Same as host.

Occurrence : Perennial or Pseudo-perennial.

Reproduction : Plurilocular sporangia at all seasons.

Notes : Epiphytic on *Laminaria saccharina*. Common at all seasons of the year.

E. velutinus, Kütz. Not uncommon.

Fig. : Plate X, 15.

District : Port St. Mary ; Castletown.

Zone : Same as host.

Occurrence : Pseudo-perennial.

Reproduction : Unilocular sporangia abundant in late Summer ; plurilocular sporangia rare, found only in late September.

Notes : Found growing on the receptacles of *Himanthalia lorea* on the sides of deep pools and on overhanging ledges in the sublittoral zone. Appears on the young *Himanthalia* in Summer, reaches maximum in September, then diminishes until in April it is difficult to find.

E. simplex, Crn. Rare.

Fig. : Plate IX, 8, 9, 11, 12.

District : Port St. Mary.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Unilocular and plurilocular sporangia in March.

Notes : On *Codium tomentosum*.

E. terminalis, Kütz. Rare.

Fig. : Plate X, 14.

District : Port Erin, Port St. Mary.

Zone : M.T. zone.

Occurrence : Sporadic.

Reproduction : Unilocular and plurilocular sporangia in Winter.

Notes : Scraped from the surface of limpet shells.

E. confervoides, Le Jol. Common.

Fig. : Plate VIII, 3, 4.

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaish.

Zone : M.T. zone and below.

Occurrence : Annual, Spring, and Summer.

Reproduction : Unilocular sporangia rare, developed spring and Autumn ; plurilocular sporangia common in Summer.

Notes : Common, sometimes abundant, on rock surfaces, also epiphytic on other algae.

E. siliculosus, Kütz. Common.

Fig.: Harvey I, 80. Knight (1929).

District: In all districts.

Zone: M.T. zone downwards.

Occurrence: Pseudo-perennial.

Reproduction: Plants in Spring and Autumn bear unilocular sporangia. Plurilocular sporangia general from March to August.

Notes: Common on littoral zone in Spring and Summer in sheltered situations; reduced in Winter to filamentous creeping or adherent plantlets reproducing by plurilocular sporangia.

E. fasciculatus, Harv., var. *typica*. Frequent.

Fig.: Harvey I, 83. Plate XI, 23, 25.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaish.

Zone: L.W.O.N.T. to L.W.O.S.T.

Occurrence: Pseudo-perennial.

Reproduction: Unilocular and plurilocular sporangia on same plant. March to August.

Notes: Usually occurs as an epiphyte on *Laminaria* and *Himanthalia* fronds. Spring is the period of most luxuriant growth, but can be found in Winter as battered relics on the *Laminaria* fronds. In Summer the plants are covered with diatoms.

E. fasciculatus, Harv. var. *draparnaldioides*, Crn. Rare.

Fig.: Plate XIX, 80.

District: Port St. Mary.

Zone: L.W.O.N.T. to L.W.O.S.T.

Occurrence: Pseudo-perennial.

Reproduction: Unilocular and plurilocular sporangia in Spring and Summer.

Notes: Generally found mixed with *E. fasciculatus*, var. *typica*.

E. fasciculatus, Harv. var. *refracta* Ardissoni.

Fig.: Plate VIII, 5, 6.

District: Port St. Mary.

Zone: L.W.O.N.T. to L.W.O.S.T.

Occurrence: Pseudo-perennial.

Reproduction: Unilocular sporangia from Feb. to April, plurilocular sporangia from March to June.

E. tomentosus, Lyngb. Abundant.

Fig.: Harvey I. 85.

District: In all districts.

Zone: Same as host.

Occurrence: Pseudo-perennial.

Reproduction: Unilocular sporangia in Spring and Autumn; plurilocular sporangia common all Summer.

Notes: Common everywhere in the summer, especially as an epiphyte on *Fucus vesiculosus* and *Fucus serratus*. Minute creeping filaments bearing plurilocular sporangia present in the Winter; in Spring these give rise to the typical upright plants.

E. ovatus, Kjellm. var. *arachnoideus*, Rke. Very rare.

Fig. : Plate XII, 30.

Reproduction : Unilocular and plurilocular sporangia in Winter.

Notes : Found in lobster tank at Marine Biological Station.

E. Hincksiae, Harv. Locally abundant.

Fig. : Harvey I, 84.

District : Port Erin.

Zone : Same as host.

Occurrence : Pseudo-perennial.

Reproduction : Plurilocular sporangia present all Summer ; unilocular sporangia rare and formed only in Spring.

Notes : Epiphytic on *Laminaria* thalli, especially *Saccorhiza polyschides*. During winter basal parts only remain. Best growth in spring and early Summer. Has occasionally been found on species of *Fucus*.

E. granulosus, Ag. Not uncommon.

Fig. : Harvey I, 92.

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaish.

Zone : L.W.O.S.T. and below.

Occurrence : Pseudo-perennial.

Reproduction : Plurilocular sporangia common in Summer (suspected to be of two types with unequal sized loculi). Unilocular sporangia occasional in Spring on same thallus as plurilocular sporangia.

Notes : Deep water form generally found in situations where there is plenty of water movement ; frequently forms a fringe round the rim of the Breakwater buoy (Port Erin).

Gen. *Pylaiella*, Bory.

P. littoralis, Kjellm. Abundant.

Fig. : Knight (1923).

District : In all districts.

Zone : H.W.O.N.T. to L.W.O.N.T.

Occurrence : Pseudo-perennial.

Reproduction : Plurilocular sporangia normal to plants growing on *Ascophyllum nodosum*. Unilocular sporangia usual on plants growing on *Fucus* species. Both types of host may bear occasional plants with unilocular and plurilocular sporangia.

Notes : One of the commonest *Ectocarpaceae* found between tide marks. Most luxuriant in summer but persisting as somewhat truncated diatom-covered plants in winter.

Gen. *Isthmoplea*, Kjellm.

I. sphaerophora, Kjellm. Not common.

Fig.: Harvey I, 93 [as *Ectocarpus sphaerophorus*]. Plate IX, 18.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaaish.

Zone: Same as host.

Occurrence: Pseudo-perennial.

Reproduction: Unilocular sporangia in Spring and early Summer; plurilocular sporangia in Summer.

Notes: Casual in sheltered places generally epiphytic on *Plumaria elegans* and *Cladophora rupestris*. Most readily recognisable by the unilocular sporangia but plants bearing plurilocular sporangia only may have been confused with other *Ectocarpaceae* and so have escaped record.

Gen. *Myriotrichia*, Harv.

M. clavaeformis, Harv. Frequent.

Fig.: Kuckuck (1899), p. 39.

District: In all districts.

Zone: Same as host.

Occurrence: Annual, Summer.

Reproduction: Unilocular and plurilocular sporangia on the same thallus; plurilocular sporangia predominate at beginning of Summer, unilocular at the end.

Notes: First makes its appearance in May or June as an epiphyte on other *Phaeophyceae* (occasionally on *Enteromorpha*). Host plants are frequently Summer annuals, e.g. *Chordaria*, *Castagnea*, *Dictyosiphon*. Winter form unknown.

M. filiformis, Harv. Not common.

Fig.: Kuckuck (1899), p. 40. Plate XI, 21, 22.

District: Port Erin; Castletown.

Zone: Same as host.

Occurrence: Summer annual.

Reproduction: See *Myriotrichia clavaeformis*; same type of reproduction.

Notes: Generally found epiphytic on *Dictyosiphon foeniculaceus*.

Fam. *ARTHROCLADIACEÆ*.

Gen. *Arthrocladia*, Duby.

A. villosa. Duby. Rare.

Fig.: Harvey I, 20.

District: Fleshwick Bay.

Zone: Sub-littoral.

Occurrence: Summer.

Reproduction: Unilocular sporangia.

Notes: One record only, dredged.

Fam. *ELACHISTACEAE*.Gen. *Myriactis*, Kütz.

M. pulvinata, Kütz. Not common.

Fig.: Kuckuck (1929), p. 39.

District: Pooyllvaash.

Zone: L.W.O.N.T.

Occurrence: No data.

Reproduction: Unilocular and plurilocular sporangia in Summer.

Notes: Found growing on fronds of *Halidrys* in deep pools in the low tide zone.

M. stellulata, Batt. Not common.

Fig.: Harvey I, 62. [as *Elachista stellulata*].

District: Port Erin; Port St. Mary; Peel.

Zone: Same as host.

Occurrence: Summer annual.

Reproduction: Unilocular and plurilocular sporangia from end of June to the beginning of September.

Notes: Epiphytic on *Dictyota dichotoma*.

M. Haydeni, Batt.

Fig.: Kuckuck (1929) p. 38.

District: Port Erin.

Zone: Same as host.

Occurrence: Sporadic.

Reproduction: No data.

Notes: An epiphyte growing on *Scytosiphon lomentarius* has been provisionally referred to this species. The plants were young—no sporangia were formed, hence precise identification was not possible.

Gen. *Elachista*, Duby.

E. fucicola, Fries. Common.

Fig.: Harvey I, 59.

District: In all districts.

Zone: Same as host.

Occurrence: Perennial or pseudo-perennial.

Reproduction: Unilocular sporangia at all times of the year; plurilocular sporangia unknown.

Notes: Common everywhere on *Fucus vesiculosus* and *Fucus serratus*; more plentiful in the Summer.

E. flaccida, Aresch. Not common.

Fig.: Harvey I, 60.

District: Port St. Mary.

Zone: Same as host.

Occurrence: Annual, Spring.

Reproduction: Unilocular sporangia in Summer.

Notes: Epiphytic on *Halidrys siliquosa*.

E. scutulata, Duby. Frequent.

Fig. : Harvey I, 63.

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot).

Zone : Same as host.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia in Summer.

Notes : Occurs epiphytically on the *Himanthalia* thongs in Spring, Summer and early Autumn.

Gen. *Leptonema*, Reinke.

L. fasciculatum, Rke, var. *majus*, Rke. Very rare. (See note 5, p. 110.)

Fig. : Plate XIII, 35, 36, 39.

District : Port Erin.

Zone : M.T. zone.

Occurrence : Sporadic.

Reproduction : Plurilocular sporangia in February and March.

Unilocular sporangia developed in April.

Notes : Found growing epiphytically on *Cladostephus spongiosus* and on the byssi of *Mytilus*.

Fam. *SPHACELARIACEAE*.

Gen. *Sphacelaria*, Lyngb. (See note 6, p. 111.)

S. radicans, Harv. Not common.

Fig. : Harvey I, 78.

District : Port Erin ; Port St. Mary ; Pooyllvaish.

Zone : M.T. zone.

Occurrence : Perennial.

Reproduction : Unilocular sporangia in Spring ; no record for plurilocular sporangia.

S. cirrhosa, Ag., var. *pennata*, Hauck. Frequent.

Fig. : Harvey I, 76.

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot) ; Peel.

Zone : M.T. zone and below in pools.

Occurrence : Perennial.

Reproduction : Unilocular sporangia in Winter. Frequently bears propagules.

Notes : This species may be found as an epiphyte on *Desmarestia aculeata*.

S. cirrhosa, Ag., var. *fusca*, Holm et Batt. Rare. (See note 7, p. 111.)

Fig. : Harvey I, 77 [as *S. fusca*].

District : Port Erin ; Port St. Mary ; Douglas Bay (Brady).

Zone : M.T. zone in pools.

Occurrence : Perennial.

Reproduction : Unilocular sporangia in winter. Frequently bears propagules.

S. bipinnata, Sauv. Frequent. (See note 8, p. 112.)

Fig. : Clint, 1927.

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaaish.

Zone : L.W.O.S.T.

Occurrence : Perennial.

Reproduction : Unilocular and plurilocular sporangia developed in the Summer.

Notes : Found as an epiphyte on *Halidrys siliquosa* in deep pools at low water mark.

Gen. *Chaetopteris*, Kütz.

Ch. plumosa, Kütz. Occasional.

Fig. : Harvey I, 75 [as *Sphacelaria plumosa*].

District : Port Erin ; Douglas Bay (Talbot) ; Peel.

Zone : L.W.O.N.T.

Occurrence : Perennial.

Reproduction : Unilocular sporangia in Spring.

Notes : Occasional in deep pools at low water mark or sometimes cast up.

Gen. *Cladostephus*, Ag.

C. spongiosus, Ag. Frequent.

Fig. : Harvey I, 71.

District : In all districts.

Zone : M.T. zone and below.

Occurrence : Perennial.

Reproduction : Unilocular and plurilocular sporangia on separate individuals in Winter.

Notes : Generally found on sand or mud-covered rocks.

C. verticillatus, Ag. Frequent.

Fig. : Harvey I, 70.

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot) ; Peel ; Pooyllvaaish.

Zone : M.T. zone and below.

Occurrence : Perennial.

Reproduction : Unilocular and plurilocular sporangia in Winter.

Gen. *Halopteris*, Kütz.

H. filicina, Kütz. Very rare.

Fig. : Harvey I, 72 [as *Sphacelaria filicina*].

District : Port Erin ; Port St. Mary.

Zone : L.W.O.S.T. and below.

Occurrence : Perennial.

Reproduction : Unilocular sporangia in Spring.

Halopteris flicina Kütz, var. *sertularia* (Bonnem.)Fig.: Harvey I, 73 [as *Sphacelaria sertularia* Bonnem].

District: Fleshwick Bay.

Zone: Sub-littoral.

Occurrence: No data.

Reproduction: Unilocular sporangia in August.

Notes: Single record only, dredged.

Gen. **Stypocaulon**, Kütz.*S. scoparium*, Kütz. Occasional.Fig.: Harvey I, 74 [as *Sphacelaria scoparia*].

District: Port Erin; Castletown; Douglas Bay (Talbot).

Zone: L.W.O.S.T. and below.

Occurrence: Perennial or biennial.

Reproduction: Unilocular sporangia in Autumn.

Fam. MYRIONEMACEAE.

Gen. **Myrionema**, Grev.*M. strangulans*, Grev., var. *typica*, Batt. Frequent.

Fig.: Harvey I, 66.

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Brady, Talbot).

Zone: Same as host.

Occurrence: Sporadic.

Reproduction: Unilocular sporangia in Summer.

Notes: Frequent on *Enteromorpha* and *Ulva*.*M. strangulans*, var. *punctiforme*, Holm et Batt.Fig.: Harvey I, 68 [as *M. punctiforme*].

Note: Recorded by Talbot. No data available.

M. aecidioides, Sauv. Frequent.Fig.: Oltmanns III, p. 469 [as *Phycocelis aecidioides*].

District: Port Erin.

Zone: Same as host.

Occurrence: Pseudo-perennial.

Reproduction: Plurilocular sporangia in Spring.

Notes: Occurs commonly on *Laminaria digitata*.*M. saxicola*, Kuck. Rare.

Fig.: Kuckuck (1897), p. 390, figs. 13 and 14.

District: Port St. Mary.

Zone: M.T. zone.

Occurrence: No data.

Reproduction: Unilocular sporangia in Winter.

Gen. **Ulonema**, Foslie.*U. rhizophorum*, Foslie. Occasional.

Fig.: Plate IX, 7, 10, 13.

District: Port Erin; Port St. Mary.

Zone: Same as host.

Occurrence: Sporadic.

Reproduction: Unilocular sporangia in June.

Notes: Commonly on *Dumontia incrassata*.

Gen. *Hecatonema*, Sauv.

H. maculans, Sauv. Occasional.

Fig.: Plate X, 17.

District: Port Erin; Port St. Mary.

Zone: Same as host.

Occurrence: Sporadic.

Reproduction: Plurilocular sporangia in early Autumn.

Notes: Usually found epiphytic on *Corallina officinalis*.

Gen. *Chilionema*, Sauv.

C. Nathaliae, Sauv.

Fig.: Harvey I, 67 [as *Myrionema Leclancherii*].

District: Douglas Bay; Peel.

Notes: Recorded by Harvey-Gibson and Brady. No data available.

Gen. *Ascocyclus*, Magn. (See note 9, p. 112.)

A. orbicularis, Magn. Not common.

Fig.: Børgesen (1926), *Phaeophyceae*, p. 63.

District: Port St. Mary; Douglas Bay (Talbot).

Notes: On the leaves of *Zostera*.

A. Saccharinae, Cotton. Not common.

Fig.: Cotton, 1912, Pl. X. Plate XII, 26, 31.

District: Port Erin.

Zone: Same as host.

Occurrence: Sporadic.

Reproduction: Plurilocular sporangia in Winter.

Notes: Found on *Laminaria saccharina*.

Gen. *Ralfsia*, Berk.

R. verrucosa, Aresch. Frequent.

Fig.: Harvey I, 58 [as *R. deusta*].

District: Port Erin; Port St. Mary.

Zone: H.W.O.N.T.

Occurrence: Perennial.

Reproduction: Unilocular and plurilocular sporangia in Winter.

Notes: Often found covering limpet shells in any zone, but forming conspicuous confluent discs in rock pools near H.W.O.N.T.

Gen. *Lithoderma*, Aresch.

L. fatiscens, Aresch. Rare.

Fig.: Oltmanns II, p. 15.

District: Port St. Mary.

Zone: M.T. to L.W.O.N.T.

Occurrence: Sporadic.

Reproduction: Unilocular sporangia in February.

Notes: Scraped from the surface of limpet shells.

Fam. *CHORDARIACEAE*.Gen. *Stilophora*, J.Ag.*S. rhizodes*, J. Ag.

Fig. : Harvey I, 39.

District : Port Erin.

Note : Single specimen cast up in Summer bearing unilocular sporangia.

Gen. *Chordaria*, Ag.*C. divaricata*, Ag. Very rare.

Fig. : Harvey I, 52.

District : Port Erin.

Reproduction : Unilocular sporangia in Summer.

Notes : Has only been found cast up on the shore in Summer.

C. flagelliformis, Ag. Frequent.

Fig. : Harvey I, 51.

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay (Talbot).

Zone : H.W.O.N.T. to M.T. zone.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia in Summer and early Autumn.

Notes : Found in pools generally bearing *Dictyosiphon foeniculaceus* as an epiphyte. Appears beginning of July and disappears at the end of November.Gen. *Mesogloia*, Ag.*M. vermiculata*, Le Jol. Frequent. (See note 10, p. 113.)Fig. : Harvey I, 53 [as *M. vermicularis*].

District : Port Erin ; Douglas Bay (Brady, Talbot).

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia in Summer.

Notes : Occurs in deep pools in sheltered positions.

Gen. *Castagnea*, Derb. et Sol.*C. virescens*, Thur. Common.Fig. : Harvey I, 55 [as *Mesogloia virescens*].

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay (Brady, Talbot).

Zone : M.T. zone pools.

Occurrence : Annual, Summer.

Reproduction : Unilocular sporangia in Summer, beginning at the end of May ; plurilocular sporangia in September.

Gen. Leathesia, S. F. Gray.

L. difformis, Areseh.

Fig.: Harvey I, 56 [as *L. tuberiformis*, S. F. Gray].

District: In all districts.

Zone: In all zones.

Occurrence: Annual, Summer.

Reproduction: Unilocular sporangia produced all through the Summer; plurilocular sporangia developed at the end of August.

Notes: Found growing on rock surfaces or epiphytically on other algae. Appears in March or April, grows rapidly, reaching its maximum size in July. Plants begin to degenerate early in September.

Fam. SPOROCHNACEAE.

Gen. Sporochnus, Ag.

S. pedunculatus, Ag. Not common.

Fig.: Harvey I, 21.

District: Peel; Douglas Bay (Mrs. Gatty); Fleshwick Bay; Bay Fine.

Occurrence: Annual, Summer.

Reproduction: Unilocular sporangia in August and September.

Notes: Dredged from deep water or occasionally cast up.

Fam. CHORDACEAE.

Gen. Chorda, Stackh.

C. filum, Stackh. Common.

Fig.: Harvey I, 30.

District: Port Erin; Port St. Mary; Douglas Bay (Talbot); Peel.

Zone: L.W.O.N.T. and below.

Occurrence: Pseudo-perennial.

Reproduction: Unilocular sporangia in Spring and Summer.

Notes: Forms colonies in sheltered places at low tide zone or in deep low lying pools. Can be found as scattered plants at all times of the year, but most plentiful in Summer.

C. tomentosa, Lyngb.

District: Port Erin.

Note: Recorded by R. J. Harvey-Gibson. No data available.

Fam. LAMINARIACEAE.

Gen. Laminaria, Lamour.

L. saccharina, Lamour. Common.

Fig.: Harvey I, 27.

District: In all districts.

Zone: L.W.O.N.T.

Occurrence: Perennial.

Reproduction: General.

L. saccharina, var. *Phyllitis*, Le Jol.

Note : Recorded by R. J. Harvey-Gibson. No data available.

L. digitala, Lamour var. *typica*, Foslie. Common.

Fig. : Harvey I, 24.

District : In all districts.

Zone : L.W.O.N.T.

Occurrence : Perennial.

Reproduction : Spring and Summer.

Notes : Forms well-marked belt on flat shores extending into sub-littoral zone.

L. Cloustoni, Edm. Frequent.

Fig. : Hauck, p. 397.

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaish.

Zone : Below L.W.O.S.T.

Occurrence : Perennial.

Reproduction : General.

Notes : Common in deep water with certain amount of shelter.

Gen. *Saccorhiza*, De La Pyl.

S. polyschides, Batt. Not uncommon.

Fig. : Harvey I, 25 [as *Laminaria bulbosa*].

District : In all districts.

Zone : Below L.W.O.S.T.

Occurrence : Perennial.

Reproduction : At any time.

Gen. *Alaria*, Grev.

A. esculenta, Grev. Common.

Fig. : Harvey I, 23.

District : In all districts.

Zone : L.W.O.N.T. and below.

Occurrence : Perennial (or biennial).

Reproduction : Reproductive branches at all times of the year.

Notes : Generally found in positions where water movement is pronounced.

Fam. *CUTLERIACEAE*.

Gen. *Cutleria*, Grev.

C. multifida, Grev.

Fig. : Harvey I, 32.

District : Douglas Bay (Talbot) ; Fleshwick Bay ; Bay Fine.

Zone : Sub-littoral.

Occurrence : Annual, Summer.

Reproduction : Male and female gametangia.

Notes : Dredged from deep water, August 1931. First record since 1890.

Asexual form (*Aglaozonia*, Zan.)

A. reptans, Crn. Rare.

Fig.: Harvey I, 36 [as *Zonaria parvula*]. Plate XVI, 61.

District: Port Erin; Fleshwick Bay.

Zone: M.T. zone and below.

Occurrence: February to September.

Reproduction: Sporangia in Spring and Summer.

Notes: Found on stones in shallow pools, but also on stones dredged from deep water.

Sub-Order. FUCINEAE.

Fam. FUCACEAE.

Gen. **Fucus**, Dene. et Thur.

F. ceranoides, L. Not uncommon.

Fig.: Harvey I, 11.

District: Port Erin; Port St. Mary; Fleshwick Bay.

Zone: H.W.O.N.T. and L.W.O.N.T.

Occurrence: Perennial.

Reproduction: Autumn and Winter.

Notes: Only found where fresh water runs down from the land.

F. spiralis L., var. *platycarpus*, Thur. Common.

Fig.: Oltmanns II, p. 191 [as *F. platycarpus*].

District: In all districts.

Zone: H.W.O.N.T.

Occurrence: Perennial.

Reproduction: From March until November.

Notes: Generally forms a definite zone below the *Pelvetia* zone and above the *Ascophyllum* zone.

F. vesiculosus, L. Common.

Fig.: Harvey I, 10.

District: In all districts.

Zone: M.T. zone and above.

Occurrence: Perennial.

Reproduction: At all times; most abundant in June and July.

Notes: Sometimes occurs in isolated patches but frequently forms a distinct zone (Pooyllvaish).

F. serratus, L. Abundant.

Fig.: Harvey I, 12.

District: In all districts.

Zone: M.T. zone and below.

Occurrence: Perennial.

Reproduction: Autumn and Winter; occasional in Spring and Summer.

Notes: Forms distinct zone immediately above the *Laminaria* zone except when *Himanthalia lorea* is present.

Gen. *Ascophyllum*, Stackh.

A. nodosum, Le Jol. Common.

Fig.: Harvey I, 13 [as *Fucus nodosus*].

District: In all districts.

Zone: Between H.W.O.N.T. and M.T. zone.

Occurrence: Perennial.

Reproduction: From February onwards.

Notes: Conspicuous in places where rocks are broken up to form boulders: generally forms a definite zone below *Fucus spiralis* and above *Fucus serratus*.

Gen. *Pelvetia*, Dene. et Thur.

P. canaliculata, Dene. et Thur.

Fig.: Harvey I, 16 [as *Fucus canaliculatus*].

District: Port Erin; Perwick Bay; Fleshwick Bay; Pooyllvaish; Douglas Bay; Peel.

Zone: H.W.O.S.T.

Occurrence: Perennial.

Reproduction: Summer.

Gen. *Himanthalia*, Lyngb.

H. lorea, Lyngb. Locally abundant.

Fig.: Harvey I, 15.

District: Port Erin (Bradda); Port St. Mary; Castletown; Port Soderick (Talbot); Calf (Garner).

Zone: L.W.O.N.T.

Occurrence: Perennial.

Reproduction: From February onwards.

Notes: Forms zone immediately above Laminarian zone.

Gen. *Halidrys*, Lyngb.

H. siliquosa, Lyngb. Frequent.

Fig.: Harvey I, 3.

District: In all districts.

Zone: L.W.O.S.T. and below.

Occurrence: Perennial.

Reproduction: Summer.

Notes: May be found higher up the shore in deep pools. Generally occurs in sheltered situations.

Gen. *Cystoseira*, Ag.

C. ericoides, Ag.

Fig.: Harvey I, 4.

District: Douglas Bay.

Notes: Collected by R. Garner. No data available.

C. discors, Ag.

Fig.: Harvey I, 8.

District: Douglas Bay.

Notes: Collected by R. Garner. No data available.

C. fibrosa, Ag.

Fig.: Harvey I, 7.

District: Douglas Bay.

Notes: Collected by R. Garner. No data available.

Sub-Order. **TILOPTERIDEAE.**Gen. **Tilopteris**, Kütz.*T. Meriensii*, Kütz. Very rare.

Fig.: Oltmanns II, p. 174.

District: Pooyllvaaish.

Zone: M.T. zone.

Occurrence: Annual, Spring.

Reproduction: Monosporangia and plurilocular sporangia in April.

One record only. April, 1931.

Gen. **Achinetospora**, Born.*A. pusilla*, Born, var. *crinita*, Batt.

Fig.: Oltmanns II, p. 173.

District: Port Erin; Port St. Mary.

Notes: No data available. Recorded by R. J. Harvey-Gibson.

Sub-Order. **DICTYOTEAE.**Fam. **DICTYOTACEAE.**Gen. **Dictyota**, Lamour.*D. dichotoma*, Lamour. Frequent.

Fig.: Harvey I, 38.

District: In all districts.

Zone: M.T. zone and below.

Occurrence: Pseudo-perennial.

Reproduction: Tetrasporic plants prevalent in Autumn; sexual plants in Spring and early Summer. Both types may, however, occur simultaneously.

Notes: Basal parts recognisable in Winter.

D. dichotoma, var. *implexa*, J. Ag. Not common.Fig.: Harvey I, 38 [as *D. dichotoma* var. *intricata*].

District: Port Erin.

Zone: Cast ashore (probably from deep water).

Reproduction: Tetrasporic plants in Autumn.

Notes: Numerous plants cast ashore in October.

D. ligulata, Kütz.

Notes: Recorded by R. J. Harvey-Gibson for Port Erin and Port St. Mary. No other data available.

Gen. **Dictyopteris**, Lamour.*D. membranacea*, Batt. Rare.Fig.: Harvey I, 33 [as *Haliseris polypodioides*].

District: Port Erin; Douglas Bay (Talbot).

Zone: Dredged in deep water.

Reproduction: Tetrasporic plants in Winter.

RHODOPHYCEAE.

Sub-Order. PORPHYREAE.

Fam. PORPHYRACEAE.

Gen. **Erythropeltis**, Schm.*E. discigera*, Schm., var. *Flustrae*, Batt. Rare.

Fig.: Plate XIX, 75, 76.

District: Port Erin.

Notes: Epiphytic on *Flustra*. Dredged outside Port Erin Bay.Gen. **Erythrotrichea**, Aresch.*E. carnea*, J. Ag. Frequent.Fig.: Oltmanns II, p. 234 [as *E. ceramicola*].

District: Port Erin, Port St. Mary.

Occurrence: Sporadic.

Reproduction: Monospores in November.

Notes: Appeared in large quantities, epiphytic on *Cladophora flavescens*, in outside fish tanks of Port Erin Biological Station.*E. Boryana*, Berth.

District: Peel.

Notes: Single record. No data available.

Gen. **Bangia**, Lyngb.*B. fuscopurpurea*, Lyngb. Frequent.

Fig.: Harvey IV, 345.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaish.

Zone: H.W.O.N.T. to M.T. zone generally.

Occurrence: Pseudo-perennial.

Reproduction: Spring and Summer.

Notes: Common in certain localities. Together with *Urospora sp.* it forms a well-marked zone on large stones at high water mark at Port Erin and Pooyllvaish. It is also frequent on the walls of the Harbour Works and of the Raglan Pier. It is most noticeable in Spring and Summer. Isolated threads may be found on limpets in Winter.Gen. **Porphyra**, Ag.*P. coccinea*, J. Ag. Very rare.

Fig.: Kuckuck (1897), p. 390.

District: Port Erin.

Zone: Below L.W.O.S.T.

Occurrence: Annual.

Notes: Only occurs as an epiphyte on *Desmarestia aculeata*.*P. leucosticta*, Thur. Frequent.

Fig.: Oltmanns II, p. 231.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaish.

Zone: H.W.O.S.T. to H.W.O.N.T.

Occurrence: Annual.

Reproduction: Spring and early Summer.

P. linearis, Grev. Frequent.

Fig.: Harvey IV, 344 [as *P. vulgaris*].

District: Port Erin; Port St. Mary; Castletown; Pooyllvaaish; Douglas Bay (Talbot).

Zone: L.W.O.N.T. to M.T. zone.

Occurrence: Pseudo-perennial.

Reproduction: January and February.

Notes: Common in winter; appears to be the winter form of *Porphyra umbilicalis*, Kutz, var. *laciniata*, J. Ag.

P. umbilicalis, Kutz, var. *laciniata*, J. Ag. Common.

Fig.: Harvey IV, 343 [as *P. laciniata*].

District: In all districts.

Zone: H.W.O.S.T. to H.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: Tetrasporangia in Spring.

Notes: Common in Spring and early Summer; can withstand considerable exposure but is frequently destroyed in Summer when sunny calm weather prevails. Forms a conspicuous zone on smooth rock surfaces usually forming a closed society.

Sub-Order. EUFLORIDEAE.

Fam. HELMINTHOCLADIACEAE.

Gen. **Erythrocladia**, Rosenv.

E. subintegra, Rosenv. Rare. (See note 11.)

Fig.: Rosenvinge I (1909), p. 74.

District: Port Erin.

Zone: Dredged in deep water.

Occurrence: Sporadic.

Reproduction: Monospores in March.

Notes: On *Polysiphonia spinulosa*, var. *major* (on *Desmarestia aculeata*).

Gen. **Colaconema**, Batt.

C. reticulatum, Batt. Very rare. (See note 12, p. 114.)

Fig.: Plate XIV, 45.

District: Port St. Mary.

Zone: M.T.

Occurrence: Occasional.

Reproduction: April.

Notes: Endophytic in the walls of young sporelings of an undetermined species of *Cladophora*.

Gen. **Acrochaetium**, Näg.

A. emergens, Rosenv. (= *C. emergens*, Rosenvinge.) (See note 14, p. 115) Rare.

Fig.: Rosenvinge (1909), part I, p. 128.

District: Port Erin.

Zone: Dredged in deep water.

Occurrence: Sporadic.

Reproduction: Monospores in May.

Notes: On *Polysiphonia spinulosa*, var. *major* (on *Desmarestia aculeata*).

A. endozoicum, Batt. Rare. (See note 13, p. 114.)

Fig.: Plate XIII, 34, 40.

District: Port Erin.

Zone: L.W.O.S.T.

Occurrence: Sporadic.

Reproduction: Monospores in Spring.

Notes: Parasitic in *Alcyonidium hirsutum* on *Delesseria alata*; recorded March, 1931. Previous record by Professor Darbyshire in April, 1902. In the latter case the *Alcyonidium* was on *Phycodrys rubens*.

A. virgatulum, J. Ag. Not uncommon.

Fig.: Harvey III, 279 [as *Callithamnion virgatulum*].

District: Port Erin; Port St. Mary; Douglas Bay (Brady, Talbot).

Zone: H.W.O.N.T. to M.T. in pools.

Occurrence: Sporadic.

Reproduction: Monospores and tetraspores from January to March.

Notes: Appears spasmodically covering everything within a very short time. Cystocarpia and antheridia not recorded for this area.

A. Daviesii, Näg.

Fig.: Harvey III, 278 [as *Callithamnion Daviesii*].

District: Port St. Mary; Douglas Bay (Mrs. Gatty).

Notes: Recorded by R. J. Harvey-Gibson. No data available.

Gen. *Nemalion*, Targioni-Tozzetti.

N. multifidum, J. Ag. Not common.

Fig.: Harvey III, 218.

District: Port St. Mary; Peel.

Zone: M.T. zone.

Occurrence: Annual, Summer.

Reproduction: Spermatia and Cystocarpia in July and August.

Notes: Found attached to limpet shells in pools. Appears sporadically.

Gen. *Helminthocladia*, J. Ag.

H. purpurea, J. Ag. Rare.

Fig.: Harvey III, 219 [as *Nemalion* ? *purpureum*].

District: Port Erin; Peel; Douglas Bay (Talbot).

Zone: L.W.O.N.T. to L.W.O.S.T.

Occurrence: Annual, Summer.

Reproduction: Summer.

Notes: Occasional in Port Erin Bay in Summer; large quantity found at Peel in 1913.

Gen. *Helminthora*, J. Ag.

H. divaricata, J. Ag.

Fig.: Hauck, p. 58.

District: Port St. Mary.

Notes: Single record; cast up in Summer.

Fam. *CHAETANGIACÆ*, Schm.

Gen. *Scinaia*, Bivona.

S. furcellata, Bivona.

Fig. : Hauck, p. 62. Harvey III, 210 [as *Ginnania furcellata*].

District : Fleshwick Bay.

Zone : Sub-littoral.

Occurrence : Annual, Summer.

Reproduction : Cystocarps.

Notes : Single record, dredged from deep water August, 1931.

Gen. *Choreocolax*, Reinsch.

C. polysiphoniae, Reinsch. Not uncommon.

Fig. : Plate XVI, 58.

District : Port Erin.

Zone : Same as host.

Occurrence : Sporadic.

Notes : Parasitic on the fronds of *Polysiphonia fastigiata*.

Gen. *Harveyella*, Schm. et Rke.

Fam. *GELIDIACEAE*.

H. mirabilis, Schm. et Rke. Rare.

Fig. : Oltmanns III, p. 487.

District : Port Erin ; Port St. Mary.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : No data.

Notes : Parasitic on the fronds of *Rhodomela subfusca*.

Gen. *Naccaria*, Endl.

N. Wigghii, Endl.

Fig. : Harvey III, 216.

District : Douglas Bay (Mrs. Gatty, Marrat); Fleshwick Bay ; Aldrick Bay.

Occurrence : Annual, Summer.

Reproduction : No data.

Notes : Dredged in August.

Gen. *Pterocladia*, J.Ag.

P. capillacea, Born. Very rare.

Fig. : Hauck, p. 191 [as *Gelidium capillaceum*].

District : Castletown.

Zone : M.T. zone.

Notes : Occasional in pools in Summer.

Gen. *Gelidium*, Lamour.

- G. crinale*, J. Ag., var. *genuinum*, Hauck. Not uncommon.
 Fig.: Harvey III, 191 (5) [as *G. corneum*, var. *crinale*].
 District: Port Erin; Port St. Mary; Castletown; Peel; Douglas Bay (Talbot).
 Zone: H.W.O.N.T. to L.W.O.N.T.
 Occurrence: Pseudo-perennial.
 Reproduction: In Winter.
 Notes: Generally found in exposed situations.
- G. pusillum*, Le Jol. Frequent.
 Fig.: Börgesen, F. Rhodophyceae III, p. 84 (1927).
 District: Port Erin; Port St. Mary; Castletown; Pooyllvaaish.
 Zone: M.T. zone in pools.
 Occurrence: Pseudo-perennial.
 Reproduction: In Winter.
- G. pulchellum*, Kütz. Occasional.
 Fig.: Harvey III, 191 (4) [as *G. corneum* var. *pulchellum*].
 District: Port St. Mary.
 Zone: L.W.O.N.T.
 Occurrence: Pseudo-perennial.
 Reproduction: No data.
 Notes: Generally found fringing the margin of tide pools in places shaded by other algae.
- G. corneum*, Lamour. Not common.
 Fig.: Harvey III, 191 (1).
 District: Port Erin; Port St. Mary; Fleshwick; Douglas Bay (Talbot).
 Zone: H.W.O.N.T. to below L.W.O.S.T.
 Occurrence: Pseudo-perennial.
 Reproduction: In Winter.
- G. latifolium*, Born. Frequent.
 Fig.: Harvey III, 191 (3) [as *G. corneum* var. *latifolium*].
 District: Port Erin; Port St. Mary.
 Zone: L.W.O.S.T. and below.
 Occurrence: Pseudo-perennial.
 Reproduction: Tetraspores and cystocarpia in Winter.
 Notes: Found growing on rocks in deep water.

Fam. GIGARTINACEAE.

Gen. *Chondrus*, Stackh.

- C. crispus*, Stackh. Very common.
 Fig.: Harvey III, 197.
 District: In all districts.
 Zone: M.T. zone downwards.
 Occurrence: Perennial.
 Reproduction: Cystocarpia, spermatia and tetrasporangia in Winter.
 Notes: Common everywhere in lower half of littoral zone and extending into deep water. Frequent component of undergrowth of *Fucus* and *Laminaria* species; very variable in form.

Gen. **Gigartina**, Stackh.

G. stellata, Batt. Common.

Fig. : Harvey III, 196 [as *G. mamillosa*].

District : In all districts.

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : At all times of year.

Notes : Found in same situations as *Chondrus crispus*.

Gen. **Phyllophora**, Grev.

P. epiphylla, Batt. Frequent.

Fig. : Harvey III, 199 [as *P. rubens* Grev.]

District : In all districts.

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Perennial.

Reproduction ; Cystocarpia in March.

P. Brodiaei, J. Ag. Very rare.

Fig. : Harvey III, 201.

District : Port Erin ; Port St. Mary ; Pooyllvaish.

Zone : L.W.O.N.T. in pools.

Occurrence : Perennial.

Reproduction : No data.

P. palmettoides, J. Ag.

Fig. : Harvey III, 202.

District : Douglas Bay.

Notes : Recorded by Talbot. No data available.

P. membranifolia, J. Ag. Frequent.

Fig. : Harvey III, 202.

District : Port Erin.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Perennial.

Notes : Generally found in deep pools ; local in distribution.

Gen. **Gymnogongrus**, Martius.

G. Griffithsiae, Martius.

Fig. : Harvey III, 204.

District : Port Erin (Gatty) ; Douglas Bay (Talbot).

Zone : L.W.O.N.T.

Reproduction : No data.

Notes : Recorded by Batters (1902).

G. Norvegicus J. Ag.

Fig. : Harvey III, 198 [as *Chondrus norvegicus*].

Notes : Recorded by Batters (1902).

Gen. *Ahnfeldtia*, Fries.

A. plicata, Fries. Common.

Fig.: Harvey III, 205 [as *Gymnogongrus plicatus*].

District: In all districts.

Zone: L.W.O.N.T. and below.

Occurrence: Perennial.

Reproduction: Nemathecia in Spring.

Notes: According to Rosenvinge, the so-called parasite, *Sterrocolax decipiens*, is the true nemathecium of the *Ahnfeldtia*.

Gen. *Actinococcus*, Kütz.

A. subcutaneus, Rosenv. Rare.

Fig.: Rosenvinge, 1929. "*Phyllophora Brodiaei* and *Actinococcus subcutaneus*."

District: Port Erin; Port St. Mary.

Notes: Parasitic on *Phyllophora Brodiaei*. Recorded by R. J. Harvey-Gibson. No other data available. According to Rosenvinge *Actinococcus* is an asexual generation of *Phyll. Brodiaei* growing parasitically on the sexual generation.

Gen. *Sterrocolax*, Schm.

S. decipiens, Schm. Frequent (see note 15, p. 115).

Fig.: Rosenvinge (1930).

District: Same as host.

Zone: Same as host.

Note: Parasitic on *Ahnfeldtia plicata*; see notes under *Ahnfeldtia*.

Gen. *Callophyllis*, Kütz.

C. laciniata, Kütz. Not uncommon.

Fig.: Harvey II, 178 [as *Rhodymenia laciniata*].

District: Port Erin; Port St. Mary; Douglas Bay (Talbot); Peel.

Zone: L.W.O.N.T. and below.

Occurrence: Pseudo-perennial.

Reproduction: Tetrasporic plants predominate in Spring; cystocarpic plants in Summer.

Gen. *Callymenia*, J. Ag.

C. reniformis, J. Ag. Very rare.

Fig.: Harvey III, 211.

District: Port Erin.

Notes: Occasional only; cast ashore.

Fam. RHODOPHYLLIDACEAE.

Gen. *Cystoclonium*, Schm.

C. purpureum, Batt. Common.

Fig.: Harvey II, 189 [as *Hypnea purpurascens*].

District: In all districts.

Zone : M.T. zone downwards.

Occurrence : Pseudo-perennial.

Reproduction : Spermatia in Spring : cystocarpia in Summer.

Notes : Very common in pools in the littoral zone in Spring and Summer. Absent from littoral zone in Winter but recognisable on "limpet island" flora in January as minute plants half-inch long. Antheridial plants smaller than the cystocarpic plants.

Gen. *Catenella*, Grev.

C. repens, Batt. Frequent.

Fig. : Harvey III, 214 [as *C. opuntia*].

District : Port Erin, Port St. Mary ; Fleshwick ; Douglas Bay (Brady, Talbot).

Zone : M.T. zone.

Occurrence : Annual, Summer.

Reproduction : Cystocarpia in Summer.

Notes : Forms dark masses lining the crevices of rocks in shady places about half tide zone. Is usually to be found well above the zone of *Lomentaria articulata*, which, apart from colour, it somewhat resembles.

Gen. *Euthora*, J. Ag.

E. cristata, J. Ag. Very rare.

Fig. : Harvey II, 180 [as *Rhodymenia cristata*].

District : Peel ; Douglas Bay (Talbot).

Zone : L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Cystocarpia in Summer ; Tetraspores not recorded.

Gen. *Rhodophyllis*, Kütz.

R. bifida, Kütz. Frequent.

Fig. : Harvey II, 177 [as *Rhodymenia bifida*].

District : In all districts.

Zone : L.W.O.S.T. and below.

Occurrence : Pseudo-perennial.

Reproduction : Tetraspores and cystocarpia at all times of the year ; most abundant in Spring and Summer. Tetraspores and cystocarpia on separate plants.

Fam. *SPHAEROCOCCACEAE*.

Gen. *Sphaerococcus*, Grev.

S. coronopifolius, Grev. Not common.

Fig. : Harvey II, 184.

District : In all districts.

Zone : Below L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Tetraspores and cystocarpia in Summer.

Notes : Though not a rarity this plant occurs as single individuals in deep water. Usually found as a cast-up.

Gen. **Gracilaria**, Grev.*G. confervoides*, Grev. Rare.

Fig.: Harvey II, 187.

District: Port Erin; Douglas Bay (Talbot); Pooyllvaish.

Zone: M.T. zone and below.

Occurrence: Pseudo-perennial.

Reproduction: Cystocarpia in Summer.

Notes: Found only in restricted localities; solitary plants in Winter, locally abundant in Summer.

Gen. **Calliblepharis**, Kütz.*C. ciliata*, Kütz.Fig.: Harvey II, 181 [as *Rhodymenia ciliata*].

District: Douglas Bay (Mrs. Gatty); Peel.

Zone: Below L.W.O.S.T.

Occurrence: Annual, Summer.

Reproduction: No data.

Notes: Deep water form, usually found as a cast-up.

C. lanceolata, Batt. Locally common.Fig.: Harvey II, 182 [as *Rhodymenia jubata*].

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Talbot)

Zone: M.T. zone to L.W.O.N.T. in pools.

Occurrence: Pseudo-perennial or perennial.

Reproduction: June and July. Cystocarpia and spermatia recorded.

Notes: Not a conspicuous component of the flora but occurring here and there in fair quantities. Prefers illuminated situations.

Fam. **RHODYMENIACEAE**.Gen. **Rhodymenia**, J. Ag.*R. palmetta*, Grev.Fig.: Harvey II, 179. var. *a*.

District: Port Erin.

Notes: Recorded by R. J. Harvey-Gibson. No data available.

R. palmata, Grev., var. *typica*, Batt. Very common.Fig.: Harvey II, 183. var. *a*.

District: In all districts.

Zone: L.W.O.N.T. to L.W.O.S.T. and below.

Occurrence: Perennial.

Reproduction: Tetraspores in Winter and early Spring; spermatia in Spring; no record for cystocarpia.

R. palmata Grev. var. *marginifera* Harv.Fig.: Harvey II, 183. var. *β*.

District: All districts.

Zone: L.W.O.N.T. to L.W.O.S.T. and below.

Occurrence: Perennial.

Reproduction: See var. *typica* above.Notes: Forms conspicuous accompaniment to Laminarian zone; frequently attached to *Laminaria* stipes.

Gen. *Lomentaria*, Lyngb.

L. articulata, Lyngb. Common.

Fig.: Harvey II, 146 [as *Chylocladia articulata*].

District: In all districts.

Zone: M.T. zone to L.W.O.S.T.

Occurrence: Perennial.

Reproduction: Tetraspores in Winter; cystocarpia in Spring; single plants bearing tetraspores may be found at all times of the year. Spermatia developed in February and March.

Notes: Common as accompaniment of *Polysiphonia urceolata* and *Plumaria elegans* as a covering to rock surfaces in sheltered positions at low water level or just above; also common component of pool flora.

L. clavellosa, Gail. Frequent.

Fig.: Harvey II, 140 [as *Chrysomenia clavellosa*].

District: In all districts.

Zone: M.T. zone downwards.

Occurrence: Annual, Summer.

Reproduction: Tetraspores in Spring and Summer.

Notes: Found as occasional plants in pools or on rock surfaces. Can be found in February as minute plantlets one-eighth inch high, attached to limpet shells.

L. rosea, Thur., var. *orcadensis*, Harv. Very rare.

Fig.: Harvey II, 141 [as *Chrysomenia rosea*, var. *orcadensis*].

District: Port Erin; Port St. Mary; Perwick Bay.

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: Tetraspores in Spring and Summer.

Notes: Only occasionally found in Spring and Summer amongst other algae fringing the edge of deep pools. Can be found in the same pools year after year.

Gen. *Champia*, Lamour.

C. parvula, Harv. Rare.

Fig.: Harvey II, 145 [as *Chylocladia parvula*].

District: Port Erin; Douglas Bay (Talbot).

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Annual, Summer.

Reproduction: No data.

Notes: Found in similar situations to *Lomentaria rosea*.

Gen. *Chylocladia*, Grev.

C. kaliformis, Hook. Frequent.

Fig.: Harvey II, 143 (a).

District: In all districts.

Zone: M.T. zone to L.W.O.S.T. in pools.

Occurrence: Annual, Summer.

Reproduction: Cystocarpia in Summer,

C. kaliformis, Hook, var. *squarrosa*, Harv. Very rare.

Fig. : Harvey II, 143 (b).

District : Port Erin.

Zone : No data. Cast ashore.

Reproduction : Cystocarpia in July.

C. ovalus, Batt. Common.

Fig. : Harvey II, 142 [as *C. ovalis*].

District : In all districts.

Zone : M.T. zone to L.W.O.N.T. in pools.

Occurrence : Perennial.

Reproduction : Tetraspores in Spring ; cystocarpia in Summer.

Gen. *Plocamium*, Lyngb.

P. coccineum, Lyngb. Common.

Fig. : Harvey II, 175. *

District : In all districts.

Zone : L.W.O.S.T. and below.

Occurrence : Pseudo-perennial.

Reproduction : Cystocarpia in Spring and Summer ; tetraspores in Summer and Autumn.

Notes : Deep water form ; rarely found attached but cast up in large quantities.

Fam. *DELESSERIACEAE*.

Gen. *Nitophyllum*, Grev.

N. punctatum, Grev. Not common.

Fig. : Harvey II, 169.

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay (Talbot) ; Fleshwick Bay.

Zone : L.W.O.N.T.

Occurrence : Annual, Summer.

Reproduction : Tetraspores and cystocarpia in Spring and Summer.

N. uncinatum, J. Ag. Occasional.

Fig. : Kylin, 1924, p. 78 [as *Acrosorium uncinatum*].

District : Port Erin ; Port St. Mary.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : No data.

Notes : Occurs in deep pools in sheltered situations.

N. Gmelini, Grev. Rare.

Fig. : Harvey II, 172.

District : Port Erin ; Peel.

Notes : Recorded by R. J. Harvey-Gibson,

N. ramosum, Batt. Frequent.

Fig. : Harvey II, 173 [as *Nitophyllum laceratum*].

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaaish ;
Douglas Bay (Talbot).

Zone : L.W.O.N.T. downwards.

Occurrence : Pseudo-perennial.

Reproduction : Tetraspores in Summer ; cystocarpia in Autumn.

Notes : Can be found at all times of the year ; most luxuriant growth
in Spring and early Summer.

N. ramosum, Batt. var. *uncinatum*, Grev.

Fig. : Cotton (1912), Plate XVIII, 71.

District : Fleshwick Bay.

Notes : Dredged, single specimen only, in August, 1931.

Gen. *Phycodrys*, Kütz.

P. rubens, Batt. Common.

Fig. : Harvey II, 164 [as *Delesseria sinuosa*].

District : In all districts.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Perennial.

Reproduction : Tetraspores in Spring ; cystocarpia from Spring to
Autumn.

Notes : Commonly found epiphytic on the stipes of *Laminaria* ; also
occurs in pools.

Gen. *Delesseria*, Schm.

D. sanguinea, Lamour. Common.

Fig. : Harvey II, 163.

District : In all districts.

Zone : L.W.O.N.T. downwards.

Occurrence : Perennial.

Reproduction : In Autumn and Winter.

Notes : Can be found at all times of the year but is best from April
to June. Basal parts only remain during Winter.

D. alata, Lamour. Very common.

Fig. : Harvey II, 165.

District : In all districts.

Zone : L.W.O.N.T. downwards.

Occurrence : Perennial.

Reproduction : Tetraspores and cystocarpia in Winter and Spring ;
spermatia only recorded for Spring.

Notes : Very common component of pool and rock flora of lower littoral
zone ; also occurs in deep water on the stipes of *Laminaria*.

D. angustissima, Griff.

Fig. : Harvey II, 166.

District : Port Erin.

Notes : Recorded by R. J. Harvey-Gibson. No data available.

D. ruscifolia, Lamour. Occasional.

Fig.: Harvey II, 168.

District: Port Erin; Port St. Mary; Perwick; Douglas Bay
(Talbot, Brady).

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Perennial.

Reproduction: Cystocarpia in Autumn; tetraspores in Winter.

D. hypoglossum, Lamour. Frequent.

Fig.: Harvey II, 167.

District: In all districts.

Zone: M.T. zone to L.W.O.S.T.

Occurrence: Perennial.

Reproduction: Tetraspores in Winter; cystocarpia in Summer.

Notes: Common component of pool and rock flora; also occurs on
stipes of *Laminaria Cloustoni*.

Fam. *BONNEMAISONIACEAE*.

Gen. *Bonnemaisonia*, Ag.

B. asparagoides, C. Ag. Rare.

Fig.: Harvey II, 134.

District: Port Erin; Douglas Bay (Brady, Talbot). Fleshwick Bay.

Zone: Below L.W.O.S.T.

Occurrence: Annual, Summer.

Reproduction: Cystocarpia in July, August and September.

Notes: Cast up material, or dredged from deep water.

Fam. *RHODOMELACEAE*.

Gen. *Rhodomela*, Ag.

R. subfusca, Ag. Common. (See note 17, p. 116.)

Fig.: Harvey II, 100.

District: In all districts.

Zone: M.T. zone to L.W.O.S.T.

Occurrence: Pseudo-perennial.

Reproduction: Cystocarpia, spermatia and tetraspores in Winter and
Spring.

Notes: Common in the fringe of algae round margins of pools;
disappears at the end of May, but can be found in the sub-
littoral zone in the Summer.

R. lycopodioides, Ag. Not common.

Fig.: Harvey II, 99.

District: Port Erin; Port St. Mary; Peel; Douglas Bay (Talbot).

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Annual, Spring.

Reproduction: No data.

Notes: Found in similar situations to *Rhodomela subfusca*.

Gen. *Odonthalia*, Lyngb.

O. dentata, Lyngb. Frequent.

Fig. : Harvey II, 98.

District : In all districts.

Zone : L.W.O.S.T. and below.

Occurrence : Perennial.

Reproduction : Cystocarpia in Spring and Summer ; tetraspores in Spring and Autumn.

Notes : This is a plant of deep water situations. It can be found attached in pools at low water level but is more frequently met with as a cast-up.

Gen. *Laurencia*, Lamour.

L. obtusa, Lamour. Frequent.

Fig. : Harvey II, 137.

District : In all districts.

Zone : L.W.O.N.T. downwards.

Occurrence : Annual, Summer.

Reproduction : Cystocarpia and spermatia in August.

Notes : Plant dark red at first but turns yellow with exposure to bright illumination.

L. hybrida, Lenor. Common.

Fig. : Harvey II, 136 [as *L. caespitosa*].

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaish.

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Perennial.

Reproduction : Spermatia in Winter ; cystocarpia and tetraspores in Spring.

Notes : Very common plant in Spring on the limestone terraces at Port St. Mary. It occurs on limpets, as the floor covering of shallow pools and as a carpet in inter-pool vegetation. It is a perennial with great powers of proliferation.

L. pinnatifida, Lamour. Abundant.

Fig. : Harvey II, 135.

District : In all districts.

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : Cystocarpia, spermatia and tetraspores in Winter.

Notes : Generally occurs fringing the edges of pools.

Gen. *Chondria*, Ag.

C. tenuissima, Ag. Occasional. (See note 16, p. 116.)

Fig. : Harvey II, 139 [as *Laurencia tenuissima*].

District : Port Erin ; Douglas Bay (Talbot).

Zone : L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Tetraspores in Summer ; no other data available.

C. dasyphylla, Ag. Occasional.

Fig. : Harvey II, 138 [as *Laurencia dasyphylla*].

District : Port Erin ; Peel.

Zone : L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : Antheridia in July ; no other data available.

Gen. **Polysiphonia**, Grev.

P. fibrata, Harv.

Fig. : Harvey II, 109.

District : Douglas Bay.

Notes : Recorded by Brady and Batters ; no data available.

P. urceolata, Grev., var. *typica*, J. Ag. Common.

Fig. : Harvey II, 106.

District : In all districts.

Zone : M.T. zone to L.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : Cystocarpia and spermatia in Spring and Autumn ;
tetraspores in Winter and Spring.

Notes : Pool alga in mid-tide zone, also component of general rock
covering in lower littoral zone. Disappears in early winter
but re-attached fragments shew vigorous growth from
February onwards.

P. spinulosa, Grev. Very rare.

Fig. : Harvey II, 110.

District : Port St. Mary.

Zone : M.T. zone.

Occurrence : Pseudo-perennial.

Reproduction : Cystocarpia in Autumn.

P. spinulosa, Grev., var. *major*, J. Ag. Not common.

Fig. : Harvey II, 116 [as *P. Carmichaeliana*].

District : Port Erin ; Castletown.

Zone : Same as host.

Occurrence : Annual, Summer.

Reproduction : Cystocarpia in Summer.

Notes : Only found growing as an epiphyte on *Desmarestia aculeata*.

P. elongella, Harv. Rare.

Fig. : Harvey II, 113.

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay
(Gatty, Talbot).

Zone : L.W.O.N.T. and below.

Occurrence : Pseudo-perennial.

Reproduction : No data.

Notes : On rocks and stones and on the smaller algae near low water
mark and at greater depth.

P. elongata, Grev. Common.

Fig.: Harvey II, 114 (2 plates).

District: In all districts.

Zone: L.W.O.S.T. and below.

Occurrence: Perennial.

Reproduction: Cystocarpia in Spring and Summer; tetraspores in Summer, spermatia in Spring.

P. violacea, Grev. Frequent.

Fig.: Harvey II, 115.

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Brady, Talbot).

Zone: M.T. zone and below in pools.

Occurrence: Pseudo-perennial.

Reproduction: Cystocarpia and spermatia in Spring; tetraspores in Summer.

P. fibrillosa, Grev. Not common.

Fig.: Harvey II, 117

District: Port Erin; Douglas Bay (Mrs. Gatty)

Zone: M.T. zone in pools.

Occurrence: Pseudo-perennial.

Reproduction: In Spring.

P. fastigiata, Grev. Very common.

Fig.: Harvey II, 127.

District: In all districts.

Zone: Same as host.

Occurrence: Perennial.

Reproduction: Cystocarpia at all times of the year; spermatia in Spring and Autumn; tetraspores in Autumn.

Notes: Common everywhere on *Ascophyllum nodosum*.*P. nigra*, Batt.Fig.: Harvey II, 125 [as *P. atro-rubescens*].

District: Douglas Bay, Fleshwick Bay.

Occurrence: Sub-littoral zone.

Reproduction: Cystocarpia in August.

Notes: Recorded by Talbot. Dredged in August, 1931.

P. nigrescens, Grev. Common.

Fig.: Harvey II, 122.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaish.

Zone: M.T. zone and below in pools.

Occurrence: Perennial or pseudo-perennial.

Reproduction: Cystocarpia in Winter and Spring; spermatia only recorded for Spring; no record for tetraspores.

P. Brodiaei, Grev., var. *typica*, Holm et Batt. Frequent.

Fig.: Harvey II, 118.

District: In all districts.

Zone: M.T. zone to L.W.O.N.T. in pools.

Occurrence: Pseudo-perennial.

Reproduction: In Winter and Spring; spermatia abundant.

P. fruticulosa, Spreng. Not common.

Fig.: Harvey II, 105 [as *Rytiphloea fruticulosa*].

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Brady, Talbot).

Zone: M.T. zone to L.W.O.N.T. in pools.

Occurrence: Perennial.

Reproduction: Spermatia in Spring; cystocarpia in Spring; tetraspores in Summer.

Gen. *Pterosiphonia*, Falk.

P. parasitica, Schm. Rather rare.

Fig.: Harvey II, 128 [as *Polysiphonia parasitica*].

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Brady, Talbot).

Zone: M.T. zone to L.W.O.S.T.

Occurrence: Perennial or pseudo-perennial.

Reproduction: Although this plant has been examined at all times of the year, no reproductive organs have been observed.

Notes: Found under overhanging ledges in sheltered pools.

P. thuyoides, Schm. Locally common.

Fig.: Harvey II, 104 [as *Rytiphloea thuyoides*].

District: Port Erin; Port St. Mary; Pooyllvaish; Castletown; Douglas Bay (Brady, Talbot).

Zone: M.T. zone downwards in pools.

Occurrence: Perennial.

Reproduction: Cystocarpia, spermatia and tetraspores in Spring.

Gen. *Brongniartella*, Bory.

B. byssoides, Bory. Common.

Fig.: Harvey II, 129 [as *Polysiphonia byssoides*].

District: In all districts.

Zone: L.W.O.S.T. and below.

Occurrence: Annual, Summer.

Reproduction: Cystocarpia in July and August; tetraspores in September.

Gen. *Dasya*, Ag.

D. arbuscula, Ag. Frequent.

Fig.: Harvey II, 132.

District: In all districts.

Zone: M.T. zone to L.W.O.S.T. in pools.

Occurrence: Perennial.

Reproduction: Cystocarpia and spermatia in Summer; tetraspores in Autumn.

D. ocellata, Harv.

Fig.: Harvey II, 131.

District: Douglas Bay.

Notes: Recorded by Talbot; no data available.

Gen. *Heterosiphonia*, Mont.

H. plumosa, Batt. Common.

Fig.: Harvey II, 130 [as *Dasya coccinea*].

District: In all districts.

Zone: L.W.O.N.T. and below.

Occurrence: Perennial.

Reproduction: Cystocarpia in Summer and Autumn; tetraspores in Autumn.

Notes: Basal parts only to be found in Winter; young shoots appear in March.

Fam. CERAMIACEAE.

Gen. *Spondylothamnion*, Näg.

S. multifidum, Näg. Rare.

Fig.: Harvey III, 247 [as *Wrangelia multifida*]. Plate XVII, 63.

District: Port Erin; Peel; Kirk Onchan (Brady); Port Jack (Talbot).

Zone: Below L.W.O.S.T.

Occurrence: Annual, Summer.

Reproduction: Tetraspores in August.

Gen. *Spermothamnion*, Aresch.

S. Turneri, Aresch. Frequent.

Fig.: Harvey III, 252 [as *Callithamnion Turneri*].

District: In all districts.

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: In Winter.

Notes: Can be found persistently in certain definite localities.

S. barbatum, Born, var. *mesocarpum*, Batt.

Fig.: Harvey III, 276 [as *Callithamnion mesocarpum*].

District: Port Erin.

Notes: Recorded by R. J. Harvey-Gibson. No data available.

Gen. *Trailliella*, Batt.

T. intricata, Batt. Occasional.

Fig.: Rosenvinge (1909), pt. III, p. 306. Plate XIV, 43, 44.

District: Port Erin; Port St. Mary; Castletown; Pooyllvaais.

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Appears to be an annual.

Reproduction: No data.

Notes: Epiphyte on pool algae, chiefly *Corallina officinalis*.

Gen. *Ptilothamnion*, Thuret.

P. pluma, Thur.

Fig.: Harvey III, 254 [as *Callithamnion pluma*].

District: Port Erin.

Note: Single record: epiphytic on *Laminaria* stipe.

Gen. *Griffithsia*, Ag.

G. corallinoides, Batt. Not uncommon.

Fig. : Harvey III, 244 [as *Griffithsia corallina*].

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay
(Miss Thompson).

Zone : M.T. zone to L.W.O.N.T.

Occurrence : Annual, Spring and Summer.

Reproduction : Cystocarpia, spermatia and tetraspores in July and August.

Notes : Plentiful in some years, hard to find in others.

G. flosculosa, Batt. Frequent.

Fig. : Harvey III, 246 [as *Griffithsia setacea*].

District : In all districts.

Zone : M.T. zone to below L.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : No periodicity in reproduction ; tetrasporic plants most abundant ; spermatia bearing plants rare.

Notes : Plants growing in deep water very much larger than those found in M.T. pools.

Gen. *Halurus*, Kütz.

H. equisetifolius, Kütz. Not common.

Fig. : Harvey III, 240 [as *Griffithsia equisetifolia*].

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaaish.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : Spermatia in Autumn.

H. equisetifolius, Kütz, var. *simplicifilum*, J. Ag. Very rare.

Fig. : Harvey III, 241 [as *Griffithsia simplicifilum*].

District : Port St. Mary.

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Pseudo-perennial.

Reproduction : No data.

Gen. *Monospora*, Solier.

M. pedicellata, Sol. Not common.

Fig. : Harvey III, 273 [as *Callithamnion pedicellatum*].

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaaish.

Zone : L.W.O.N.T. and below in pools.

Occurrence : Annual, Summer.

Reproduction : In Summer by monospores.

Gen. *Pleonosporium*, Näg.

P. Borreri, Näg. Rare.

Fig. : Harvey III, 266 [as *Callithamnion Borreri*].

District : Port Erin ; Douglas Bay (Mrs. Gatty).

Zone : L.W.O.S.T. as an epiphyte.

Occurrence : No data.

Gen. *Rhodochorton*, Näg.

R. membranaceum, Magn.

Fig.: Rosenvinge (1909), Pt. III, p. 393.

District: Port St. Mary.

Notes: Recorded by R. J. Harvey-Gibson. No data available.

R. Rothii, Näg. Common.

Fig.: Harvey III, 274 [as *Callithamnion Rothii*].

District: Port Erin; Port St. Mary.

Zone: H.W.O.N.T. to L.W.O.N.T.

Occurrence: Perennial.

Reproduction: Tetraspores in Spring.

Notes: Common on rocks in crevices or in accumulations of sand or grit.

R. floridulum, Näg.

Fig.: Harvey III, 275 [as *Callithamnion floridulum*].

District: Port Erin; Douglas Bay (Mrs. Gatty).

Notes: No data available.

Gen. *Callithamnion*, Lyngb.

C. byssoides, Arn. Not common.

Fig.: Harvey III, 262.

District: Port Erin; Kirk Onchan (Brady).

Zone: L.W.O.S.T. and below.

Occurrence: Annual, Spring and Summer.

Reproduction: Tetraspores from the end of February onwards.

C. polyspermum, Ag. Frequent. (See Note 18.)

Fig.: Harvey III, 263. Plate XVII, 64.

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Mrs. Gatty).

Zone: M.T. zone to L.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: Tetraspores in Winter.

C. scopulorum, Ag. Frequent.

Fig.: Plate XVI, 57. Plate XVII, 62.

District: Port Erin.

Zone: H.W.O.N.T.

Occurrence: Pseudo-perennial.

Reproduction: Tetraspores in Winter and Spring.

Notes: Occurs on rocks and stones near high water; very similar to *Callithamnion polyspermum* but smaller; not epiphytic.

C. roseum, Harv. Occasional.

Fig.: Harvey III, 261.

District: Port St. Mary; Douglas Bay (Talbot).

Zone: L.W.O.N.T. to L.W.O.S.T. and below.

Occurrence: Annual, Summer.

Reproduction: Spermatia and tetraspores in Summer; cystocarpia in Spring.

C. Dudresnayi, Crn. Rare.

Fig.: Harvey III, 267 [as *Callithamnion affine*]. Plate XVI, 60.
Plate XVII, 65.

District: Port St. Mary.

Zone: L.W.O.N.T. in pools.

Occurrence: Annual, Spring.

Reproduction: Tetraspores in March and April.

C. Hookeri, Ag. Common. (See Note 18, p. 110.)

Fig.: Harvey III, 260.

District: In all districts.

Zone: M.T. zone downwards.

Occurrence: Pseudo-perennial.

Reproduction: Tetraspores, cystocarpia and spermatia in Winter and Spring.

Notes: Plant begins activity in January; usually epiphytic on other algae in pools.

C. Brodiaei, Harv. *

Fig.: Harvey III, 256.

Notes: Recorded by Marrat for Isle of Man. No data for locality available.

C. arbuscula, Lyngb. Common.

Fig.: Harvey III, 255. Plate XVII, 68.

District: In all districts.

Zone: M.T. zone downwards.

Occurrence: Perennial.

Reproduction: Tetraspores in Autumn: cystocarpia and spermatia in Winter.

Notes: Nearly always found growing epiphytically, generally on *Corallina*.

C. tetragonum, Ag. Not uncommon.

Fig.: Harvey III, 257.

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Brady, Talbot); Peel.

Zone: L.W.O.N.T. to L.W.O.S.T.

Occurrence: Pseudo-perennial.

Reproduction: Cystocarpia, spermatia and tetraspores in Winter and Spring; the sexual and asexual organs often found on the same plant.

Notes: Generally epiphytic on other algae in low lying pools.

C. brachiatum, Bonnem. Frequent.

Fig.: Harvey III, 258. Mathias, 1928. Plate XVIII, 74.

District: Port Erin; Port St. Mary; Castletown; Douglas Bay (Talbot); Peel.

Zone: M.T. zone downwards.

Occurrence: Pseudo-perennial.

Reproduction: Cystocarpia, spermatia and tetraspores in Autumn and Winter.

Notes: Found growing epiphytically on other algae in well-illuminated pools.

C. corymbosum, Lyngb. Not common.

Fig : Harvey III, 271. Plate XVIII, 73.

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay (Talbot).

Zone : L.W.O.N.T. to L.W.O.S.T.

Occurrence : Annual, Spring and Summer.

Reproduction : No data.

Notes : In pools epiphytic on larger algae.

C. granulatum, Ag. Occasional.

Fig. : Harvey III, 272 [as *Callithamnion spongiosum*].

District : Pooyllvaish ; Douglas Bay (Brady, Talbot).

Zone : L.W.O.N.T.

Occurrence : Annual, Summer.

Gen. *Seirospora*, Harv.

S. Griffithsiana, Harv. Rare.

Fig. : Harvey III, 248.

District : Douglas Bay (Miss Thompson).

Zone : Below L.W.O.S.T.

Occurrence : Annual, Summer.

Gen. *Compsothamnion*, Schm.

C. thuyoides, Schm. Rare.

Fig. : Harvey III, 270 [as *Callithamnion thuyoides*].

District : Douglas Bay.

Notes : Recorded by Mrs. Gatty : no data available.

Gen. *Plumaria*, Stachk.

P. elegans, Schm. Common.

Fig. : Harvey III, 224 [as *Ptilota sericea*].

District : In all districts.

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : Polyspores in Winter and Spring ; carpogonia abundant in March.

Notes : Common everywhere as a rock covering, not so common in pools ; prefers sheltered position in wet crevices or under fucoids ; often found epiphytic on *Laminaria* stipes.

Gen. *Ptilota*, Ag.

P. plumosa, Ag. Common.

Fig. : Harvey III, 223.

District : In all districts.

Zone : L.W.O.S.T. and below.

Occurrence : Perennial.

Reproduction : Tetraspores in Spring and Autumn ; polyspores in Spring ; cystocarpia in Autumn.

Notes : Commonly found on *Laminaria* stipes and in deep pools at low water mark.

Gen. *Antithamnion*, Näg.*A. cruciatum*, Näg. Rare.

Fig. : Harvey, III, 250 [as *Callithamnion cruciatum*]. Plate XVII, 66.

District : Port Erin. Fleshwick Bay.

Zone : L.W.O.N.T. and into sub-littoral zone.

Reproduction : Tetraspores in August.

Notes : Cast ashore on *Zostera* in November. Material all sterile.

A. plumula, Thur. Rare.

Fig. : Harvey III, 249 [as *Callithamnion plumula*].

District : Douglas Bay. Fleshwick Bay.

Zone : Sub-littoral.

Occurrence : Found in August and September.

Reproduction : Tetraspores in August, cystocarpia in September.

Notes : Dredged from deep water.

Gen. *Ceramium*, Lyngb.*C. gracillimum*, Harv. Rare.

Fig. : Harvey III, 231.

District : Port Erin ; Port St. Mary ; Castletown.

Zone : Below L.W.O.S.T.

Occurrence : Annual, Summer.

Reproduction : No data.

Notes : Generally epiphytic on the larger algae.

C. tenuissimum, J. Ag. Not common.

Fig. : Harvey III, 233 [as *Ceramium nodosum*].

District : Port Erin ; Port St. Mary ; Pooyllvaish ; Douglas Bay (Talbot).

Zone : L.W.O.N.T. to L.W.O.S.T. in pools.

Occurrence : Annual, Summer.

C. strictum, Harv. Not uncommon.

Fig. : Harvey III, 232.

District : Port Erin ; Port St. Mary.

Zone : L.W.O.N.T. in pools.

Occurrence : Annual, Spring and early Summer.

Reproduction : Tetraspores in Spring.

C. fastigiatum, Harv.

Fig. : Harvey III, 234.

District : Douglas Bay.

Notes : Recorded by Talbot ; no data available.

C. diaphanum, Roth. Not common.

Fig. : Harvey III, 230.

District : Port St. Mary ; Douglas Bay (Brady, Talbot).

Zone : M.T. zone and below in pools.

Occurrence : Annual, Summer.

Reproduction : Cystocarpia in Summer.

- C. Deslongchampsii*, Chauv. Common.
 Fig. : Harvey III, 229.
 District : In all districts.
 Zone : M.T. zone downwards.
 Occurrence : Pseudo-perennial.
 Reproduction : In Spring and Summer.
 Notes : Common pool alga ; regeneration of fragments in early Spring.
- C. circinatum*, J. Ag.
 Fig : Harvey III, 228 [as *Ceramium decurrens*].
 District : Douglas Bay.
 Notes : Recorded by Mrs. Gatty and Talbot.
- C. botryocarpum*, Griff.
 Fig. : Harvey III, 227.
 District : Douglas Bay (Talbot). Port Erin ; Pooyllvaish.
 Zone : M.T. in pools.
 Occurrence : Pseudo-perennial.
 Reproduction : Cystocarpia in Autumn.
- C. rubrum*, Ag. Very common. (See note 19, p. 117.)
 Fig. : Harvey III, 226.
 District : In all districts.
 Zone : M.T. zone downwards.
 Occurrence : Pseudo-perennial between tide marks possibly perennial in deep water.
 Reproduction : See note 19.
 Notes : Plants healthiest and most abundant in mid-tide pools ; also found epiphytic on *Fucus* species, good illumination increases percentage of tetrasporic plants.
- C. flabelligerum*, J. Ag. Not common.
 Fig. : Harvey III, 235.
 District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot).
 Zone : M.T. zone to L.W.O.N.T.
 Occurrence : Pseudo-perennial.
 Reproduction : Spermatia in Winter ; tetraspores and cystocarpia not recorded.
- C. echionotum*, J. Ag. Not common.
 Fig. : Harvey III, 236.
 District : Port Erin ; Port St. Mary ; Pooyllvaish ; Douglas Bay (Mrs. Gatty).
 Zone : M.T. zone and below in pools.
 Occurrence : Pseudo-perennial.
 Reproduction : Tetraspores in Summer.
- C. ciliatum* Ducluz. Not common.
 Fig. : Harvey III, 238.
 District : In all districts.
 Zone : M.T. zone downwards in pools.
 Occurrence : Annual, Summer.
 Reproduction : No data.

C. acanthonotum, Carm. Frequent.

Fig.: Harvey III, 237.

District: In all districts.

Zone: M.T. zone and below in pools.

Occurrence: Pseudo-perennial or perennial.

Reproduction: Tetraspores in Spring.

Gen. *Microcladia*, Grev.

M. glandulosa, Grev. Occasional.

Fig.: Harvey III, 225.

District: Port Erin; Douglas Bay (Talbot).

Zone: Cast ashore.

Occurrence: Annual, Summer.

Reproduction: No data.

Fam. *GLOIOSIPHONIACEAE*.

Gen. *Gloiosiphonia*, Carm.

G. capillaris, Carm.

Fig.: Harvey III, 217.

District: Douglas Bay.

Note: Recorded by Talbot; no data available.

Fam. *DUMONTIACEAE*.

Gen. *Dumontia*, Lamour.

D. incrassata, Lam. Common.

Fig.: Harvey III, 208 [as *Dumontia filiformis*].

District: In all districts.

Zone: H.W.O.N.T. to below L.W.O.S.T.

Occurrence: Annual, Spring and early Summer.

Reproduction: Cystocarpia, spermatia and tetraspores in Spring.

Notes: Appears in February but is covered by epiphytes at the end of May; disappears in July and August; sexual plants smaller than tetrasporic plants.

Gen. *Dudresnaya*, Bonnem.

D. verticillata. Le Jol.

Fig.: Harvey III, 220 [as *D. coccinea*, Crn.].

District: Fleshwick Bay; Bay Finc.

Zone: Sub-littoral.

Occurrence: Annual, Summer.

Reproduction: Cystocarpia in August.

Notes: Dredged on stones from deep water.

Gen. *Dilsea*, Stackh.

D. edulis, Stackh. Frequent.

Fig.: Harvey III, 213 [as *Iridaea edulis*].

District: In all districts.

Zone: L.W.O.N.T. to below L.W.O.S.T.

Occurrence: Perennial.

Reproduction: Tetraspores in October and November.

Notes: Occurs in very deep pools and on rocks below low water mark.

Fam. *NEMASTOMACEAE*.Gen. *Halarachnion*, Schm.*H. ligulatum*, Kütz. Rare.Fig. : Harvey III, 209 [as *Halymenia ligulata*].

District : Port Erin ; Port St. Mary ; Douglas Bay (Talbot) ; Fleshwick Bay.

Zone : Sub-littoral.

Occurrence : Annual, Summer.

Reproduction : Cystocarpia in September.

Notes : Dredged.

Gen. *Furcellaria*, Lamour.*F. fastigiata*, Lamour. Common.

Fig. : Harvey III, 207.

District : In all districts.

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : All types of fruiting organs in Spring and Summer.

Fam. *RHIZOPHYLLIDACEAE*.Gen. *Polyides*, Ag.*P. rotundus*, Grev. Not common.

Fig. : Harvey III, 206.

District : In all districts.

Zone : M.T. zone in sandy pools.

Occurrence : Perennial.

Reproduction : No data.

Fam. *SQUAMARIACEAE*.Gen. *Petrocelis*, J. Ag.*P. cruenta*, J. Ag. Not uncommon.Fig. : Harvey III, 215 [as *Cruoria pellita*].

District : Port Erin ; Port St. Mary.

Zone : L.W.O.N.T. to L.W.O.S.T. and below.

Occurrence : Perennial.

Reproduction : Spermatia recorded by R. J. Harvey-Gibson for Summer.

Gen. *Cruoriella*, Crn.*C. Dubyi*, Schm. Frequent.Fig. : Harvey III, 203 [as *Peyssonnelia Dubyi*].

District : Port Erin ; Douglas Bay (Talbot).

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : No data.

Notes : Occurs on rocks and stones at all seasons.

Fam. *HILDENBRANDTIACEAE*.Gen. *Hildenbrandtia*, Nardo.

H. prototypus, Nardo, var. *rosea*, Kütz. Common.

Fig. : Harvey II, 161 [as *Hildenbrandtia rubra*]. Rosenvinge, 1909.
Part II, p. 204.

District : Port Erin ; Port St. Mary ; Castletown ; Douglas Bay
(Talbot).

Zone : H.W.O.N.T. to L.W.O.S.T.

Occurrence : Perennial.

Reproduction : Tetraspores in Winter and Spring.

Notes : On rocks and stones in pools.

Fam. *CORALLINACEAE*.Gen. *Schmitziella*, Born. et Batt.

S. endoploea, Born. et Batt. •Not uncommon.

Fig. : Oltmanns III, p. 464.

District : Port Erin ; Port St. Mary.

Zone : Same as host.

Occurrence : Annual, Summer.

Reproduction : Summer.

Notes : Found on *Cladophora pellucida*.

Gen. *Melobesia*, Fosl.

M. minutula, Fosl. (See note 20, p. 118.)

Fig. : Rosenvinge, 1909, Part II, pp. 252, 253.

District : Port St. Mary.

Zone : Same as host.

Occurrence : Sporadic.

Reproduction : Spring.

Notes : Found on *Halopteris filicina*.

M. farinosa, Lam.

Fig. : Harvey II, 158.

District : Port St. Mary.

Zone : L.W.O.N.T.

Occurrence : Perennial.

Notes : Recorded by Marrat as epiphytic on *Zostera*.

M. corallinae, Solms.

Fig. : No figure available.

District : Port Erin.

Notes : Recorded by Weiss, 1900.

Gen. *Dermatolithon*, Fosl.

D. pustulatum, Fosl.

Fig. : Harvey II, 159, 160 [as *Melobesia verrucata* and *M. pustulata*].

District : Douglas Bay.

Notes : Recorded by Talbot ; no data available.

Gen. *Lithophyllum*, Fosl.

L. incrustans, Fosl. Common.

Fig. : Hauck, Plate I, 4, 5 [as *Lithothamnion polymorphum*].

District : Port St. Mary.

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : Tetraspores in Winter.

Gen. *Lithothamnion*, Fosl.

L. colliculosum, Fosl, var. *rosea*, Batt.

Notes : Recorded by Weiss 1900.

L. calcareum, Aresch. Common.

Fig. : Harvey II, 153 [as *Melobesia calcarea*].

District : Port Erin ; Fleshwick Bay ; Port St. Mary.

Zone : Well below L.W.O.S.T.

Occurrence : Perennial.

Notes : Only obtained by dredging. Bottom of Irish Sea round eastern shores of Isle of Man in many places covered with this species.

L. lichenoides, Fosl. Frequent.

Fig. : Harvey II, 156 [as *Melobesia lichenoides*].

District : Port Erin ; Port St. Mary.

Zone : M.T. zone downwards.

Occurrence : Perennial.

Reproduction : Tetraspores and cystocarpia in Autumn.

Notes : Found in pools epiphytic on *Corallina*.

L. lichenoides, Fosl, var. *agariciformis*, Fosl. Rare.

Fig. : Harvey II, 155 [as *Melobesia agariciformis*].

District : Dredged off Spanish Head.

L. Lenormandi, Fosl, var. *typica*, Fosl. Frequent.

Fig. : Hauck, 1885, Pl. III, 4. Rosenvinge II, p. 217, 218.

District : Port Erin ; Port St. Mary ; Castletown ; Pooyllvaish.

Zone : M.T. zone and below.

Occurrence : Perennial.

Reproduction : Tetraspores and cystocarpia in Summer and Autumn.

Notes : Common as a floor covering in pools.

L. membranaceum, Fosl.

Fig. : Harvey II, 157 [as *Melobesia membranacea*].

District : Port St. Mary ; Douglas Bay (Talbot).

Occurrence : Perennial.

Reproduction : Tetraspores recorded by R. J. Harvey-Gibson.

Notes : Found on the fronds of *Chondrus crispus*.

Gen. *Phymatolithon*, Fosl.

P. polymorphum, Fosl. Frequent.

Fig.: Harvey II, 152 [as *Melobesia polymorpha*].

District: Port Erin; Port St. Mary.

Zone: M.T. zone downwards.

Occurrence: Perennial.

Reproduction: No data.

Notes: On rocks and stones; very often found growing on limpet shells.

Gen. *Corallina*, Lamour.

C. officinalis, L. Abundant.

Fig.: Harvey II, 147.

District: In all districts.

Zone: M.T. zone downwards.

Occurrence: Perennial.

Reproduction: Tetraspores and cystocarpia in Winter and Spring.

Notes: Common on all coasts except boulder beaches; frequent in pools.

C. squamata, Ellis. Not common.

Fig.: Harvey II, 149.

District: Port St. Mary.

Zone: L.W.O.N.T. downwards.

Occurrence: Perennial.

Reproduction: Tetraspores and cystocarpia in Summer.

C. rubens, Ellis et Solan. Occasional.

Fig.: Harvey II, 150 [as *Jania rubens*].

District: Port Erin; Port St. Mary; Peel.

Zone: H.W.O.N.T. to L.W.O.S.T.

Occurrence: Perennial.

Reproduction: Tetraspores in Spring.

Notes: Epiphytic on the smaller algae on rock surfaces or in pools.

C. rubens, var. *corniculata*, Hauck. Occasional.

Fig.: Harvey II, 151 [as *Jania corniculata*].

District: Port Erin.

Zone: M.T. zone downwards.

Occurrence: Perennial.

Reproduction: In Spring and Summer.

Notes: Epiphytic on the smaller algae in pools, also occurs in deep water.

Gen. *Rhododermis*, Crn.

R. elegans, Crn. Not uncommon.

Fig.: Rosenvinge, (1909) Pt. II, p. 198.

District: Port Erin; Port St. Mary.

Zone: L.W.O.N.T. downwards.

Occurrence: Perennial.

Reproduction: Tetrasporangia developed in Winter.

Notes: Occurs on stones, shells, carapaces of animals and on other algae.

CRITICAL NOTES

1. *Prasiola stipitata*.

Individual plants of this species may grow to large size, reaching some inches in length. In the Port Erin district, however, the only plants found have been quite small, not more than a few cms. in length.

2. *Mikrosyphar polysiphoniae*, Kuck.

Batters' "List of British Marine Algae" in 1902 includes two species of *Mikrosyphar*, namely *M. polysiphoniae* and *M. porphyrae*, neither of which differ greatly from one another in organisation or in reproduction. They have been given specific rank on the basis of their endophytism in different host plants. In examining material on limpet shells collected at Port St. Mary in January and February, 1931, young plants of *Polysiphonia urceolata* showed a rich development of *Mikrosyphar* in the clear outer walls. At the same time thalli exactly similar to those of *Mikrosyphar* on *Polysiphonia* were also to be found in the walls of *Ceramium* sp. and of *Callithamnion arbuscula*. The *Polysiphonia*, *Ceramium* and *Callithamnion* plants were all growing in close contiguity on the same limpet and it is readily understandable that the *Mikrosyphar* plants had spread from the *Polysiphonia* to the *Ceramium* and *Callithamnion*. As the organisation and reproduction of the *Mikrosyphar* plants appeared to be exactly similar in all three cases it is proposed to regard them all three as specimens of *Mikrosyphar polysiphoniae* and not to make two new species *M. ceramiae* and *M. callithamniae*.

3. *Asperococcus fistulosus*, Hook.

(= *A. echinatus*, Grev.)

In Port Erin and on the neighbouring coast of Port St. Mary and Castletown, two forms of *Asperococcus fistulosus* are to be found. These form-variations present

some puzzling features and it has proved very difficult to decide whether they represent two independent varieties and correspond to *A. fistulosus*, Hook, and *A. fistulosus*, Hook, var *vermicularis*, Griff. recorded by Batters in his "List of British Marine Algae" and described by Harvey in "British Marine Algae," p. 43.

On the Isle of Man coast the two varieties are distinguishable by their difference in size and by the distribution of the sori. One form is attenuated and slightly acuminate and may often be of restricted size. Sterile plants of this type are not easy to distinguish at first sight from young plants of *Scytosiphon lomentarius*. Moreover, the limits of individual sori are lost by confluence of the soral margins so that the whole plant may be covered with crowded sporangia, paraphyses and hairs. Such plants are typical winter forms of the species and persist at somewhat high levels of the shore and round the margins of deep pools at mid-tide zone. They are frequently, though not invariably, covered by a well-marked mantle of mucilage hairs, a feature which is most conspicuous in early spring. The sporangia are almost exclusively plurilocular in character.

During the summer when conditions are more favourable to algal growth, another type of plant agreeing with the form regarded as typical of the species is found. These plants appear about April; they are of sturdier build than their predecessors and gradually invade the pools of the upper and middle regions of the littoral zone. They are characterised by greater size than the winter plants achieve, by well-defined independent sori and by a scarcity of mucilage hairs.

Though these two forms are quite distinct from each other, they are connected by a series of intermediate stages in which the width of the thallus, the definition of the sorus and the copiousness of hair-production are all independently variable.

The co-existence of the two extreme forms in one pool suggests their independence as distinct varieties, but a consideration of the proportional representation of these forms throughout the space of a whole year has led to the conclusion that the narrow form with confluent sporangia and many mucilage hairs is that form of the species in which it survives unfavourable conditions. This form is therefore characteristic of the winter plants and also of those which, in the summer, inhabit the less favourable zones of the littoral region. The existence of the two forms, side by side in spring is due to the fact that individuals of the winter flora persist into the spring season, but their progeny achieve the greater stature of the summer form in response to the more favourable conditions of temperature and illumination, that govern their germination at a period when the sporelings are most sensitive to the factors of illumination and temperature.

From the foregoing it is clear that *Asperococcus fistulosus* is not an annual, as many algologists have considered but is represented throughout the year. Its presence on the shore is maintained by a succession of individuals each with a life-span of a few weeks' duration. Changing physiological conditions of the environment will affect the sensitive sporelings and thus give rise to successive crops whose morphological features vary with the seasons.

That this does not represent the whole matter is made clear by comparison with other areas. Professor Kylin in his "Studien über die Algenflora der schwedischen Westküste" refers to two forms of *Asperococcus echinatus*, namely *F. typica* and *F. villosa*, distinguished from one another by the extreme hairiness and by the confluence of the sori of the latter compared with the scarcity of hairs and clearly distinct sori of *F. typica*. *F. villosa* is also smaller in stature than *F. typica*. In many stations the length of *F. villosa* plants lies between 5 and 10 cms., but

even smaller plants, 1 or 2 cms. in length were found on which the sori were completely merged into a uniform covering of sporangia, paraphyses and hairs, thereby approaching the condition described by Reinke for *A. echinatus* var. *filiformis*. The reduced forms of *F. villosa* are connected to the normal form *F. typica* by a series of intermediates. Professor Kylin suggests that the fluctuating stature and the associated morphological features of sorus-form and hairiness are correlated with variation in salt content of sea-water. This supposition rests on the fact that at the locality where *F. typica* predominates to the exclusion of *F. villosa*, the sea-water reaches its maximum salinity for Swedish coasts and approximates to the condition of the sea-water on the Norwegian coast where *F. typica* is the normal form.

The antithesis of a winter plurilocular and a summer unilocular sporangium producing thallus is not mentioned by Professor Kylin for his Swedish plants, but it is a noticeable feature of the Isle of Man plants. The segregation is however indicative of different physiological states of the plants and not attributable to inherent factors since both types of plant have been proved to be diploid in nuclear condition and moreover, in the spring, both types of sporangia are found side by side on the same thallus. The facts of the case are that the small winter plants produce plurilocular sporangia steadily until the spring when they shew unilocular sporangia here and there in the same sorus as plurilocular sporangia. The newly developed summer plants may produce a few plurilocular sporangia at first but they very soon devote themselves exclusively to unilocular sporangium-production.

The life-history of *Asperococcus fistulosus* has been the subject of extended study by Miss H. M. Blackler whose results are incorporated in abbreviated form in this memoir.

The thallus has been shewn to be diploid in every case in which division stages of the somatic nuclei have been obtained. The diploid number has been indicated for the thallus of the small winter form as well as for the large summer form. The plurilocular sporangia are diploid throughout their history and give rise to diploid zooids. The unilocular sporangia are the seat of reduction division and release haploid zooids which function as gametes and thus give rise to diploid thalli once more. Culture of the zygotes has shewn that the first stage of germination is an ectocarpoid filament on which may arise plurilocular sporangia. The zooids released from such sporangia give rise to other filaments similar to the first. These may continue to reproduce by plurilocular sporangia until eventually a series of branches from the creeping filaments give rise to upright threads shewing early signs of longitudinal division and ultimately developing into recognisable *Asperococcus* plants. These plants have been successfully grown in cultures and have produced unilocular sporangia. The intermediate ectocarpoid filament stage is to be interpreted in the light of Professor Sauvageau's culture experiments as a *pléthysmothalle*—an interpolated phase of microscopical dimensions maintaining a succession of individuals by zooids from plurilocular sporangia until such time as conditions permitted the establishment of the macroscopic plant.

Many of the zooids released from the unilocular sporangia do not shew fusion but germinate at once into an ectocarpoid filament. The latter in its turn produces plurilocular sporangia which release haploid zooids. These behave as gametes and by their fusion reinstate the diploid condition and give rise to a diploid filament which may produce diploid plurilocular sporangia or give rise to plantules of *Asperococcus*. This provides a variant of the life-cycle. Both alternatives are indicated in the accompanying diagram of the life-cycle.

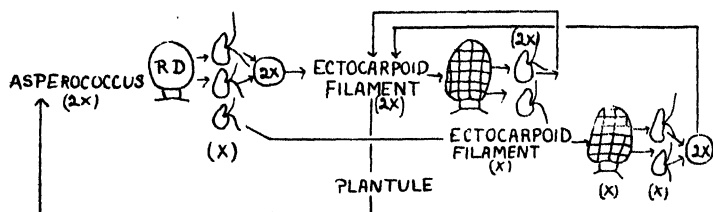


FIG. 1. The Life-Cycle of *Asperococcus fistulosus*.

4. Minute *Ectocarpus*.

In dealing with minute ectocarpoid epiphytes it is essential to know whether the basal layer of the plant is a plate formed of radiating filaments with more or less lateral coherence or whether the upright filaments arise from a branching system of horizontal threads that may be intricately tangled but do not form a pseudo-parenchymatous disc.

To decide this point it is useful to study young plants before the upright filaments make their appearance. If no young stages are available an inspection of the margin of the plant will sometimes provide information.

Care must be taken to discriminate between young stages of the larger species of *Ectocarpus* and mature individuals of minute species of *Ectocarpus* associated genera such as *Streblonema*, etc. The latter have an extensive photosynthetic horizontal thallus which makes up the dominant part of the thallus; erect filaments are small and for the most part concerned with reproduction. Young stages of larger species have a basal system of pale-coloured or colourless rhizoidal filaments of almost insignificant stature when compared with the sturdy erect filaments that may grow to considerable size before they shew signs of reproduction.

5. *Leptonema fasciculatum*, Rke. var. *majus* Rke.

Plants answering to the description given by Reinke (*Atlas deutscher Meeresalgen*) were found in the lobster

tanks at the Biological Station where they were epiphytic on *Cladostephus* and on the byssi of *Mytilus*. They did not conform to var. *subcylindrica* Rosenv. and had plurilocular sporangia developed on both sides of the filaments and hence did not agree with the description of var. *uncinatum* Rke. It appears therefore that the plants are to be referred to var. *majus*, a variety not hitherto recorded for the British Isles.

6. *Sphacelaria*.

The propagules of the genus *Sphacelaria* are short, lateral branches, tapering towards the base, provided with an apical cell which divides into three or four segments. Each segment then becomes the apical cell of a branch which thus becomes a radiate system of branches any or all of which may grow up into erect photosynthetic shoots or into rhizoidal filaments according to whether they are uppermost or undermost when the propagule leaves the parent plant and comes to rest elsewhere.

7. *Sphacelaria cirrhosa*.

Sphacelaria cirrhosa Ag. var. *fusca* Holm et Batt. is by far the commonest species at Port Erin and on the neighbouring coast. It is particularly conspicuous as a component of the pool flora in the littoral zone where it is frequently found epiphytic on *Corallina* especially in the winter when it is most abundant. The variety *fusca* differs from *Sphacelaria cirrhosa* var. *pennata*, Hauck, which is usually epiphytic on algae from deeper water, as for example, *Desmarestia aculeata*; it is usually differently divided. Var. *fusca* is less profusely branched and less regularly pinnate; it also forms irregular mats or tufts from half to one and a half inches in depth, while var. *pennata* forms almost spherical tufts on *Desmarestia* and the fronds are quite regularly pinnate or bi-pinnate. *Sphacelaria cirrhosa* var. *fusca* is almost certainly identical with the

plants referred to by Cotton in the Clare Island Survey, p. 120, which he suggests, may easily be mistaken for *Sphacelaria radicans*. In the Isle of Man district *Sphacelaria cirrhosa* var. *fusca* rarely occurs with sporangia. Occasional unilocular sporangia have been found in the winter but the plant relies chiefly on the production of propagules as a means of spreading. The plants described under the name of var. *fusca* agree with the illustration given in Harvey's "Phycologia Britannica," Vol. I, plate 149, except for the propagules. In Harvey's figure the propagules shew attenuated apices usually regarded as characteristic of branches of limited growth whereas the ends of the radiating branches of the propagules on the Manx plants shew enlarged apices usually associated with branches of unlimited growth.

8. *Sphacelaria bipinnata*, Sauv.

This plant is very similar in habit and general appearance to *Sphacelaria cirrhosa* var. *pennata* Hauck but it is almost restricted to the thalli of *Halidrys siliquosa*. It forms conspicuous globular masses when mature and was therefore originally called *Sphacelaria cirrhosa* var. *aegagropila* by Griffiths. The globular habit is not the result of rolling and tangling of the branches, but is due to regular radiation of the main fronds, hence the name *aegagropila* is undeserved and has been corrected by Sauvageau to *Sphacelaria bipinnata*. The true *aegagropila* or rolled form of *Sphacelaria cirrhosa* has not been found in this area.

9. *Ascocyclus*.

Ascocysts distinguish the genus *Ascocyclus* from other genera such as *Myrionema* or small *Ectocarpus* with which it is readily confused by the beginner. Ascocysts are spherical, ovoid, elongate or cylindrical cells filled with a dark brown homogeneous material whose composition and function is somewhat uncertain. See Figure 26.

10. *Mesogloia vermiculata*, Le Jol.

This plant is a summer annual of limited occurrence. It first appears in June as minute plants in well-sheltered localities and grows with great rapidity achieving an increase of a few inches in as many weeks. Plants collected in July, 6-8 inches in length, were plentifully provided with unilocular sporangia. Towards the end of August the plants are readily detached from their hold and washed away. They have almost entirely disappeared from the littoral zone by the middle of September.

Cultural experiments have shewn that the zoids emerging from the unilocular sporangia (haploid) germinate very slowly into minute ectocarpoid filaments bearing plurilocular sporangia. These plants are haploid and serve the function of gametophytes since the zoids from their sporangia fuse in pairs. The union of two similar gametes results in a zygote which germinates into a cellular disc completely adherent to the substratum. Up to the present the discs have shewn only the beginnings of upright filaments that will doubtless eventually develop into the macroscopic *Mesogloia* plants and so complete the life-cycle. *Mesogloia* thus falls into line with the life-cycle of *Laminaria* in possessing a macroscopic asexual phase and a microscopic gametophyte phase. It differs from *Laminaria* in that the macroscopic phase is restricted to the summer season while the minute phase alone represents the species during the winter.

11. *Erythrocladia subintegra*, Rosenv.

This plant forms minute discs adherent to the walls of *Polysiphonia spinulosa* var. *major* which was found as an epiphyte on *Desmarestia aculeata* dredged from deep water outside Port Erin Bay. The specimens have been examined and identified by Professor Rosenvinge and a description will be found in his papers on the Marine Algae of Denmark, Part I, p. 73.

This species is not included in Batters' List of the British Marine Algae published in the "Journal of Botany" in 1902, and we have not been able to find any record of its occurrence in British waters in subsequent literature; we therefore regard it as an addition to the British flora.

12. *Colaconema reticulatum*, Batt.

Particularly beautiful specimens provisionally referred to this genus were found growing as endophytes in the cell walls of species of *Cladophora* at Port Erin. The species was first described by Batters in the "Journal of Botany," Vol. XXXIV, 1896, p. 8. The specimens which Batters describes were found in the cell-wall of *Desmarestia Dresnayi*. In his description Batters refers to the establishment of a filament with a double row of cells as being due to the limited space between the cells of the host plant in which the endophyte was growing. In the specimen collected at Port Erin on *Cladophora*, the same feature of a double, treble or even four-rowed main filament is clearly shewn, though in this case the plant has had ample room for expansion. The tendency to produce a multicellular central axis is therefore specific to the plant and not a condition imposed by the restrictions of the environment.

13. *Acrochaetium* (*Chantransia*) *endozoicum*, Darb.

The limitations of the genera *Acrochaetium*, *Rhodochorton* and *Chantransia* are by no means clearly defined in the literature. Useful information may be found in a paper by K. M. Drew "A Revision of the genus *Acrochaetium*," Univ. of California. Publ. in Bot., Vol. XIV, No. 5.

Acrochaetium endozoicum was described by Professor Darbishire in the "Ber. der deutsch. bot. Gesell," 1899, and included by Professor Rosenvinge in Part I of the "Marine Algae of Denmark." Neither of the two authors give any information about the chromatophore. In the

material collected at Port Erin a single parietal chromatophore was discernible almost covering the cell wall ; a single somewhat indistinct pyrenoid was also to be seen in each cell.

14. *Acrochaetium* (*Chantransia*) *emergens*, Rosenv.

Minute endophytic filaments creeping within the substance of the cell wall of *Polysiphonia spinulosa* var. *major* (itself an epiphyte on *Desmarestia aculeata*) have been identified by Professor Rosenvinge as *Chantransia* (*Acrochaetium*) *emergens*, a species which he described for the first time in his "Marine Algae of Denmark," Part I, p. 128.

This plant corresponds very closely with a specimen described by Batters from material collected by Brebner at Plymouth ("Journal of Botany," 1896, p. 386) under the name of *Acrochaetium endophyticum*. The Plymouth material was endophytic in the cortical layers of *Heterosiphonia coccinea* (*Dasya coccinea*). The difference between the two species appears to be somewhat slight. Apart from the fact that they occur on different host genera, the main point of distinction lies in the length of the erect filaments that emerge through the wall of the host and bear the monosporangia ; in *Chantransia emergens* the monospores arise on single-celled filaments and are five to six μ in length by three to four μ in breadth, but in *Acrochaetium endophyticum* the nearly globular monospores are borne on filaments of several cells in length.

In other respects the plants appear to be identical. They may represent two forms of the same species but if they do not, *Acrochaetium emergens*, Rosenv. must be recorded as new to the British algal flora.

15. *Sterrocolax decipiens*, Schm.

There has been in the past much uncertainty as to the exact nature of rounded emergences on the thallus of *Ahnfeltia plicata*. . They have alternatively been described

as part of the reproductive processes of the *Ahnfeltia* or as entirely separate plants parasitic on the *Ahnfeltia* thallus. Recently the convergence of three research workers to the view that the emergences are integral parts of the *Ahnfeltia* and concerned with its reproduction, disposes of the "genus" *Sterrocolax*. As it has gained such a place in the literature the name is retained in this list without prejudice to the results of investigation as published by Rosenvinge ("Det. Kgl. Danske Videnskabernes Selskab, X2"), B. D. Gregory ("Annals of Botany" 44, 1930), and E. Chemon, "Bull. de la Soc. bot. de France," 77.

16. *Chondria tenuissima*.

This plant is easily confused with *Rhodomela subfusca* by the inexperienced. The two plants may be distinguished from one another by their anatomical structure.

An illustration of the organisation of the *Chondria* thallus will be found in "Oltmanns," Vol. II, p. 318, fig. 3.

17. *Rhodomela subfusca*.

An illustration of the anatomical features of this plant will be found in "Oltmanns," Vol. II, p. 310, figs. 6 and 7.

18. *Callithamnion Hookeri* and *C. polyspermum*.

Callithamnion species are not easy of identification by the beginner. Some species, as for example, *C. arbuscula* or *C. tetragonum*, are readily recognisable; others are more nearly alike in habit and are distinguishable only by minute differences of proportion or of habit of branching. Some species such as *C. Hookeri* and *C. polyspermum* shew grades of variation of stature and in method of branching within fairly wide limits, with the result that inter-grade forms between the types exist side by side (Fig. 67, Plate XVII; figs. 69, 70, Plate XVIII) and make exact determination difficult.

19. *Ceramium rubrum*, J. Ag.

Ceramium rubrum was the subject of a special study extending over two years from which valuable data was collected bearing on periodicity of reproduction. The plant is a common component of pools in the littoral zone from about half-tide level downwards but specimens attain their maximum size in the sub-littoral zone, as an examination of cast-up material will readily shew.

An analysis of the records shews that periodicity in reproduction is well marked for this plant. Large numbers were collected and examined. In January, February and March it was found that 20 per cent. of the plants were sterile, 30 per cent. bore tetraspores, and 50 per cent. were sexual with antheridia- and carpogonia-bearing plants in approximately equal proportions. From May to August cystocarpic material was abundant and predominated over the tetrasporic plants, but during the autumn the proportion of tetrasporic plants rose to 50 per cent. During the early winter months, November and December, the tetrasporic plants far outnumber the sexual plants. The periodicity is thus clearly marked, giving a preponderance of tetrasporic plants in the winter and an overwhelming majority of cystocarpic plants in the summer, but in neither case is the line of demarcation absolutely clearly cut, since tetrasporic plants persist into the early summer and cystocarpic plants are occasionally found in the winter.

The results obtained from a study of *Ceramium rubrum* thus confirm the view expressed in text books that winter is the period of tetraspore production for the Rhodophyceae and that sexually produced cystocarps are characteristic of the summer. This cycle by no means holds for all Rhodophyceae. For example, *Polysiphonia Brodiaei* shews a complete inversion of this rhythm. The majority of the autumn plants shew tetraspores while a few

individuals shew spermatia. In the winter cystocarpic individuals are in the majority. The plants usually disappear from the flora by the end of May. This lack of conformity to the usually accepted canons of behaviour for Rhodophyceae may possibly be correlated with the fact that *Polysiphonia Brodiaei* is a winter annual in the littoral zone whatever it may do in deeper waters, and makes its first appearance in the pools in October and disappears from the littoral flora by the end of May. The same data have been observed for the periodicity of occurrence and reproduction of *Rhodomela subfusca*. The plant appears in pools of the littoral zone as sporelings in November. By January, these plants have reached a stature of two or three inches and occasional plants bearing spermatia have been recorded for this period. Plants bearing tetraspores are found in March in abundance but from February onwards cystocarpic individuals appear in increasing proportions until May when the plants retreat from the littoral zone. Here again the rhythm is not very clearly defined and is associated with a winter annual habit.

20. *Melobesia minutula*, Foslie.

This minute calcareous alga has been found associated as an epiphyte with the fronds of *Halopteris filicina*. It may possibly be of common occurrence since it is present on *Halopteris* plants collected at different times from three different localities—Port St. Mary (March), Plymouth (May), and Anglesey (August). The specimens have been examined by Professor Rosenvinge and identified as *Melobesia minutula* Foslie. Under a list of synonyms, Professor Rosenvinge has included the name of *Lithocystis Allmanni*, a genus described by Harvey, "Phyc. Brit." Vol. II, Plate 166. The Port Erin specimens are, however, distinct from *Lithocystis* in that they shew minute cortical cells covering the pericentral walls of the thallus cells.

It is possible that these minute cells escaped observation in Harvey's material as they are difficult to see even under high magnification and with good illumination. In the absence of reproductive structures on Harvey's *Lithocystis* it is impossible to decide whether it is identical with *Melobesia minutula* or not. Neither *Melobesia minutula* nor *Lithocystis Allmanni* appear in Batters' list of 1902. *Melobesia minutula* would therefore appear to be a new record for the British algal flora.

THE ANALYTICAL KEY

In compiling the analytical key the authors have been obliged to relinquish, though with reluctance, the original intention of including the species, and have had to restrict themselves to the genera. This curtailment was made necessary by the fact that there still exists considerable uncertainty about the integrity of many of the species in some of the larger genera. A series of critical studies of such genera as, for example, *Callithamnion*, *Ceramium* or *Cladophora* must be undertaken before any reliable or useful specific key could be established. In the genera cited, species claimed as distinct are linked by so many intergrades that it is difficult to know where one ends and the other begins. For example, *Callithamnion Hookeri* comprises a variety of forms which grade insensibly into a condition recognisable as *Callithamnion polyspermum*. See figures 69, 70.

In constructing the key, keeping in mind the student-public for whose service the memoir is planned, morphological features or salient characters that attract attention have been given first place in diagnostic value. Such characters alone, however, are not in all cases sufficiently discriminative. As a second line of approach therefore, anatomical features have been laid under contribution,

but only as a last resource have the authors had recourse to reproductive structures as a means of distinguishing one genus from another. It is frankly admitted that the result is a distinctly unnatural association of groups of genera—a condition of affairs to be deplored but excusable perhaps on the score of convenience. In extenuation of the policy it may be urged that natural families of algae are founded largely on reproductive structures which may not be present on the material a student wishes to identify. Worse than that, discrimination between algal families sometimes rests on developmental history of complicated reproductive structures, as for example, the cystocarps of the Rhodophyceae. Scrutiny of the mature reproductive plant will yield no evidence of past phases of its development, and to build a key for the use of general botanical students on any such plan would be to assume a theoretical knowledge they might not possess and thus defeat the object of the key, which is to enable the student to arrive with the minimum of mental effort and the maximum precision at a correct identification of his plant.

It must be stated with emphasis that the key is only built to cover the genera as represented by the species present in the flora of the district under discussion. The use of the key for the flora of another area may lead the student into some difficulty.

CHLOROPHYCEAE.

- | | |
|---|---|
| 1. Microscopic endophytes or epiphytes; or, if independent plants, not taller than 3 cms. when mature | 2 |
| Macroscopic plants discernible to the naked eye as individuals, or conjointly forming conspicuous masses | 7 |
| 2. Independent plants attached to rock surfaces | 3 |
| Epiphytes or endophytes | 5 |
| 3. Plants single "celled," tubular, club-shaped with a long, tapering, colourless stalk <i>Codiolum</i> ...p. 45 | |
| Plants membranous, ovate or lanceolate, stalked, cells in groups or packets embedded in colourless matrix <i>Prasiola</i> ...p. 45 | |
| (See note 1, p. 105.) | |
| Plants tubular, branched or unbranched | 4 |

4. Plants usually unbranched, cells in regular longitudinal and horizontal rows, cells grouped in fours, each group surrounded by a definite membrane and embedded in a colourless matrix
Capsosiphon aureolus ...p. 46
 Plants branched or unbranched, cells small and irregularly arranged
Enteromorpha micrococca or young stages of other species ...p. 47
5. Thallus discoid, closely applied to the thalli of other algae
Pringsheimia ...p. 45
 Thallus of microscopic filaments growing in or on animals, shells or other algae 6
6. Filaments embedded in shells *Gomontia* ...p. 54
 Filaments immersed in the walls or creeping over the surface of animals (*Flustra*, *Sertularia*, *Alcyonidium*, etc.), or other algae *Endoderma* ...p. 49
7. Thallus a plane membrane; or formed by compression of a tubular thallus 8
 Thallus filamentous, cells uninucleate or multinucleate, but not completely coenocytic 12
 Thallus of various forms, built up of coenocytic threads; no cross-walls except where reproductive organs are found ... 11
8. Thallus a membrane, one cell layer in thickness 10
 Thallus a membrane, two cell layers in thickness *Ulva* ...p. 48
 Thallus tubular throughout, flattened or cylindrical, branched or unbranched 9
9. Plants usually unbranched, cells in regular horizontal and longitudinal rows, grouped in fours, each group surrounded by a membrane and embedded in a colourless matrix ...
Capsosiphon aureolus ...p. 46
 Plants branched or unbranched, cells small and irregularly arranged *Enteromorpha* ...p. 47
10. Thallus delicate in texture, tubular only when young, cells not shewing marked regularity in arrangement. *Monostroma* ...p. 46
 Thallus a membrane usually only few cms. long, cells arranged in definite groups or packets embedded in colourless matrix
Prasiola ...p. 45
11. Thallus of irregular coenocytic filaments, sparingly branched, not woven together to give a definite shape to the plant
Vaucheria ...p. 55
 Thallus of coenocytic filaments with a main axis and lateral branches more or less pinnately arranged ... *Bryopsis* ...p. 54
 Massive thallus of sponge-like consistency, formed of interwoven, much branched, coenocytic filaments with dilated apices
Codium ...p. 55

12. Filaments unbranched, microscopically fine, somewhat slimy to the touch 13
 Filaments coarse, visible to the naked eye as threads, branched or unbranched 14
13. Filaments of a single row of cells, of uniform width throughout, with band-shaped chromatophores and conspicuous pyrenoids in each cell *Ulothrix* ...p. 48
 Filaments of a single row of cells, of varying diameter, only the narrowest shewing band-shaped chromatophores. Wider parts of the filaments divided into narrow discoid or completely spherical cells (usually reproductive) *Urospora* ...p. 49
14. Filaments branched 15
 Filaments unbranched 16
15. Thallus of two to four rows of cells, forming a multicellular filament, sometimes twisted, not hollow and only occasionally branched *Percursaria* ...p. 46
 Thallus branched, tubular, formed of small cells arranged as in parenchyma *Enteromorpha* ...p. 47
 Thallus of semi-coenocytic filaments forming a tangled mass; filaments provided here and there with short, recurved, hook-like branches *Rhizoclonium* ...p. 51
 Thallus of semi-coenocytic filaments with a high degree of branching *Cladophora* ...p. 52
16. Filaments of a single row of large semi-coenocytic cells... .. *Chaelomorpha* ...p. 50
 Filaments two to four cells in breadth, sometimes twisted, not forming a tube *Percursaria* ...p. 46

PHAEOPHYCEAE.

- A Filamentous plants not microscopically small, monosiphonous except perhaps where fine corticating filaments clothe the base of the main axis; plants forming tufts attached by a system of rhizoidal filaments to rock surfaces or the thalli of other algae 1
- B Minute filamentous plants creeping within the tissues of animals or other algae; or forming crusts, discs, patches, hemispherical or brush-like tufts of small size (not more than a half inch long) on the thalli of other algae, on animals or on rock surfaces ... 3
- C Filamentous thalli, monosiphonous only in early stages and at the tips of the branches. Cortication by longitudinal division of the original filaments which are not provided with an enlarged and conspicuous apical cell 12

- D Thallus much branched, somewhat bristly and stiff, branches monosiphonous at the apices only; clothed with extremely regular corticating cells which may be overlaid by a system of irregular creeping filaments; branches pinnately arranged or whorled, some at least bearing a conspicuous, enlarged, apical cell, several times larger than the cell next below. Plants frequently bearing propagules (see note 7, p. 111) 15
- E Plants completely hollow, at least when mature; either irregularly distended into spherical sacs, or elongated into tubular thalli branched only at the base 18
- F Thallus of an organisation other than any included in the above alternatives 21
1. Unilocular and (or) plurilocular sporangia as lateral appendages either stalked or sessile *Ectocarpus* ...p. 60
- Plurilocular sporangia as lateral appendages. Unilocular sporangia in pairs or whorls formed by transformation of lateral segments of the cells of the filament *Isthmoplea* ...p. 64
- Unilocular and plurilocular sporangia in the course of the filament and not as lateral appendages... .. 2
2. Sporangia formed by transformation of series of consecutive cells of the filaments *Pylaiella* ...p. 63
- Plurilocular sporangia in the course of the filament; large monospores formed singly or in pairs by transformation of certain cells of the filament *Tilopteris* ...p. 75
- (See also *Achinetospora*, p. 75)
3. Thallus forming crusts on rock 5
- Thallus forming discs, patches, pustules, tufts, or brush-like coverings to other algae 6
- Thallus quite inconspicuous, consisting of irregularly branched horizontal filaments creeping on or in the walls of larger algae or animals, giving off sporangia or hairs as upright branches 4
4. Filaments creeping among the cortical cells of other algae (*Castagnea*, etc.) or on animals (*Flustra*, *Alcyonidium*), giving off as upright branches sporangia and hairs *Streblonema*. ...p. 60
- (See note 4, p. 110 and also *Ectocarpus parasiticus* and *Myrionema acidiodides*)
- Filaments creeping within the substance of thick-walled Rhodophyceae such as *Polysiphonia urceolata* *Mikrosyphar* ...p. 56
5. Basal plate from which arise upright filaments closely pressed together; unilocular and plurilocular sporangia formed by direct transformation of apical cells of the filaments *Lithoderma* ...p. 69
- Basal plate covered by pseudo-parenchymatous tissue, from which arises a covering of free filaments; unilocular and plurilocular sporangia as lateral branches from the base of free filaments arranged in sori *Ralfsia* ...p. 69

- Thallus in form of horizontal crust of parenchymatous organisation, attached to the substratum by rhizoids; central cells large, surface cells small and regular. (These surface cells are not to be confused with the closely packed terminal cells of upright filaments which are not present in this plant) ...
Aglaozonia ...p. 73
6. Filaments monosiphonous 7
 Filaments multicellular, cylindrical and unbranched
Litosiphon ...p. 57
7. Free filaments short, of approximately uniform length, standing very close together and arising from a one-layered (or occasionally two-layered) cellular plate (see note 4) 11
 Free filaments forming hemispherical or elongated tufts, not arising from a one-layered basal plate 8
8. Free filaments arising from horizontally creeping threads ... 9
 Free filaments arising from a dense core of compressed, almost colourless, pseudo-parenchymatous tissue 10
9. Free filaments (quarter to half inch long) arising in tufts; plurilocular sporangia formed by transformation and lateral extension of intercalary cells of the filaments; unilocular sporangia very large arising as lateral branches from the base of the filaments *Leptonema* ...p. 66
 Free filaments of unequal length arising irregularly from creeping filaments, bearing sporangia as lateral branches or terminally, some upright branches may be sterile and others transformed into colourless hairs.
 Minute parasitic or epiphytic species of *Ectocarpus* (see note 4, p. 110) p. 60
10. Core of closely woven pseudo-parenchymatous tissue covered by free assimilatory filaments of approximately equal length, bearing sporangia as lateral branches from their bases ...
Myriactis ...p. 65
 Core of colourless pseudo-parenchyma covered by radiating filaments of two kinds:—
 (a) Short club-shaped assimilators, with unilocular and (in some species) plurilocular sporangia as lateral branches from the base and
 (b) longer branches of much larger cells ... *Elachista* ...p. 65
11. Basal plate one cell thick throughout, covered by short, unbranched, upright assimilatory filaments; unilocular and plurilocular sporangia direct from the basal plate; plurilocular sporangia with one or more rows of loculi *Myrionema* ...p. 68
 Basal plate one cell thick throughout, with or without upright assimilatory filaments, but giving rise to sporangia, hairs and ascocysts (see note 10); plurilocular sporangia with one row of loculi *Ascocyclus* ...p. 69

- Basal plate in places two cells thick, giving off assimilatory filaments, mucilage hairs and sporangia; plant attached by rhizoids penetrating into the tissues of a host plant ...
Ulonema ...p. 68
- Basal plate in places two cells thick, giving off short filaments with terminal sporangia, or longer filaments with lateral sporangia *Hecatonema* ...p. 69
- Basal plate two cells thick, giving off upright filaments and sporangia in separate groups, surrounded by a sterile area ...
Chilionema ...p. 69
12. Thallus thread-like, cylindrical, solid or hollow polysiphonous when mature, even before sporangia are formed 13
 Thallus thread-like, cylindrical, solid, monosiphonous in young stages, becoming polysiphonous first at nodes where sporangia form *Phloeospora* ...p. 57
13. Small epiphytes about a half inch long 14
 Larger algae sparingly branched *Stictyosiphon* ...p. 57
14. Cylindrical parenchymatous, unbranched filaments, surface cells transformed into scattered unilocular or plurilocular sporangia, without much distortion of the smooth outline of the filament *Litosiphon* ...p. 57
 Club-shaped filaments thickly beset with:—
 (a) transparent hairs, and (or)
 (b) short conical branches often transformed into stumpy plurilocular sporangia and (or)
 (c) distended unilocular sporangia *Myriotrichia* ...p. 64
15. Branches coming off all round the stem or in definite whorls, giving the plant the appearance of a bottle-brush ...
Cladostephus ...p. 67
 Branches more or less pinnately arranged, not whorled... .. 16
16. Thallus irregularly pinnate, super-cortication of rhizoidal filaments at extreme base of main axis, sporangia singly as lateral appendages and not in the axils of branches ...
Sphaelaria ...p. 66
 (See note 6, p. 111.)
 Rhizoidal filaments forming an investment to most of the branches, sporangia in the axils or on special reproductive ramuli 17
17. Vegetative axes bi-pinnately branched, pinnules arising in pairs from each, or every alternate cell of the pinnae; sporangia borne on short compound branches originating from cortical cells of main axis near the apex *Chaetopteris* ...p. 67
 Vegetative axes pinnately branched (bi- or tri-pinnate), all branches arising by segmentation of the apical cell; sporangia singly in the axils of branches *Halopteris* ...p. 67

- Vegetative axes densely corticated by intricately woven filaments; main branches arising all round the stem, making a very dense and bushy plant; secondary branches pinnate; sporangia in groups hidden in the axils of branches ...
Stypocaulon ...p. 68
18. Thallus elongated and tubular 20
 Thallus rounded, irregularly lobed or sub-spherical 19
 Thallus forming a stalked "button" frequently hollow, from the centre of which spring forked thongs bearing conceptacles of oogonia and antheridia *Himanthalia* ...p. 74
19. Thallus at first solid, but soon becoming hollow, shewing two layers of tissue, the outer of which consists of radially arranged, monosiphonous assimilating threads *Leathesia* ...p. 71
 Thallus hollow, of two layers of tissue, the outer of which is apparently parenchymatous *Colpomenia* ...p. 59
20. Thallus branched only at the base, cylindrical, regularly constricted at intervals, tapering towards the apex, small cells on surface transformed into sporangia but not localised into definite sori *Scytosiphon* ...p. 59
 Thallus irregularly distended, often wider towards the apex, dotted all over with sori of colourless hairs and sporangia
Asperococcus. ...p. 59
 (See note 3, p. 105.)
 Thallus branched, branches either opposite or in whorls; unilocular sporangia developed on the surface in whorls or in patches *Striaria* ...p. 58
 Thallus at first solid, later hollow; cells of the axis increasing in size towards the periphery, but covered externally by a single layer of small cells; unilocular sporangia in external sori, accompanied by groups of club-shaped filaments forming minute dark-coloured warts over the surface *Stilophora* ...p. 70
21. Small thalli forming globular or irregularly lobed gelatinous masses less than $2\frac{1}{2}$ inches in diameter. Surface layer of the plant formed of radially arranged assimilatory filaments
Leathesia ...p. 71
 Thallus smooth, unbranched solid and whip-like, slippery to the touch, 1-6 feet or more in length. *Chorda* ...p. 71
 Thallus 3-10 inches long, branched, of extreme slipperiness; with a core of more or less coherent colourless filaments of large cells and a cortical mantle of radially arranged, club-shaped, monosiphonous branches, more or less separable under pressure 22
 Thallus of other organisation 23
22. Irregularly branched thallus, gelatinous, built up of central core of longitudinal rows of large colourless cells, not interwoven by horizontal filaments *Castagnea* ...p. 70

- Irregularly branched, gelatinous thallus built up of a central core of filaments of large cells interwoven by fine threads running in all directions ; an inner cortex of cells decreasing in size towards the periphery and giving rise to corticating assimilatory filaments arranged in groups *Mesogloia* ...p. 70
- A smooth, cylindrical, branched thallus, about $\frac{1}{8}$ inch in diameter, built up of a central core of solid tissue, large and small cells packed together ; cortex of *very* small compact, assimilatory filaments not easily separable under pressure *Chordaria* ...p. 70
23. Reproductive organs (oogonia and antheridia) sunk in conceptacles relegated to tips of fronds or borne on special lateral branches (receptacles) (Fucaceae) 24
- Reproductive organs not as above, or plant without receptacles 27
24. Lower part of thallus in form of stalked disc with long forked strap-shaped receptacles springing from its centre
Himanthalia ...p. 74
- Thallus flat, ribbon-like, much divided ; air-bladders, if present, in the course of the frond 26
- Thallus cylindrical, more or less flattened 25
25. Thallus with large oval air-bladders in the course of the main axes ; ovoid receptacles on short lateral branches, arranged in groups *Ascophyllum* ...p. 74
- Thallus pinnately branched ; long pod-like air-floats divided by septa ; receptacles on narrow forked branches
Halidrys ...p. 74
- Thallus finely divided, usually narrow (thickness of string), frequently covered with spiny emergences ; air bladders small, not very distinct, arranged in chains distending the finer branches *Cystoseira* ...p. 74
26. Small plants, 2-6 inches long, without air-bladders, growing at high water mark ; channelled thallus hanging from rock with convex surface outermost *Pelvetia* ...p. 74
- Larger algae, with or without air-bladders, not channelled ; receptacles terminal on divisions of the thallus *Fucus* ...p. 73
27. Plant a stalked disc of about 1 inch diameter *Himanthalia* ...p. 74
- Small plant, 2-6 inches long, without air-bladders, growing at high water mark ; channelled thallus hanging from rock with convex surface outermost *Pelvetia* ...p. 74
- Plants provided with definite air-floats 28
- Plants not provided with definite air-floats 30
28. Thallus flat, ribbon-like, much divided, air-floats in the course of the frond *Fucus* ...p. 73
- Thallus cylindrical, more or less flattened 29
29. Thallus with large ovoid air-bladders in the course of the main axis ; ovoid receptacles on short lateral branches, arranged in groups *Ascophyllum* ...p. 74

- Thallus pinnately branched ; long pod-like air-floats divided by septa ; receptacles on narrow forked branches *Halidrys* ...p. 74
- Thallus finely divided, usually narrow (thickness of string), frequently covered with spiny emergences ; air-bladders small, not very distinct, arranged in chains distending the finer branches *Cystoseira* ...p. 74
30. Thallus expanded into a membrane, a lamina or a ribbon ; branched or unbranched ; with or without a stem-like portion 31
- Thallus cylindrical or slightly flattened, branched or unbranched, not exceeding a quarter inch in diameter 39
31. Thallus more than 15 inches long when mature 32
- Thallus less than 15 inches long when mature 35
32. Thallus provided with a midrib 33
- Thallus without a midrib 34
33. Thin membranous papery frond with conspicuous yellow midrib, and if reproducing, a bunch of tongue-like branches, 3-8 inches long, arising from the stalk below the frond ...
- Alaria* ...p. 72
- Thallus ribbon-like, much branched, with serrated margins and marked midrib ; thallus covered with groups of mucilage hairs
- Fucus serratus* ...p. 73
34. Large leathery fronds without midrib ; stalk circular or slightly ovoid in section ; no mucilage hairs on the lamina ...
- Laminaria* ...p. 71
- Large leathery fronds with a stalk distinctly flattened into a strap $1\frac{1}{2}$ - $3\frac{1}{2}$ inches broad, sometimes with frilled lateral wings ; base irregularly bulbous covered with short tubercles ; mucilage hairs on lamina *Saccorhiza* ...p. 72
35. Thallus undivided, lanceolate, often pointed at the apex ... 36
- Thallus dichotomously or otherwise divided 37
36. Sori of unilocular and plurilocular sporangia (either or both) forming flecks or spots on the thallus ; substance somewhat delicate in texture *Punctaria* ...p. 58
- Plurilocular sporangia formed without much distention of surface cells over large areas of the thallus ; substance of the thallus tough *Phyllitis* ...p. 58
37. Thallus without midrib, more or less dichotomously divided, becoming markedly narrower towards the ends of the fronds, which are almost linear ; sori of stalked plurilocular gametangia scattered over the surface of the thallus *Culleria* ...p. 72
- Thallus dichotomously divided, either with a midrib or with fronds not conspicuously narrowed towards the apices ... 38

38. Frond with a midrib *Dictyopteris* ...p. 75
 Frond without a midrib *Dictyota* ...p. 75
39. Small plants less than 2 inches long, thin and wiry, growing on
 the leaves of *Zostera* *Phyllitis zosterifolia* ...p. 58
 Thallus branched mostly at the base, narrow, whip-like;
 composed of a solid core of large and small cells surrounded
 by a cortical mantle of short, narrow, closely packed, radial
 assimilatory filaments *Chordaria* ...p. 70
 Thallus without complete mantle of radial assimilatory filaments 40
40. Thallus traversed by a distinct axial row of cells (transverse
 section of main axis shows a single, *thick-walled*, though not
 necessarily large cell in the middle); plant often covered
 by brush-like tufts of fine silky hairs *Desmarestia* ...p. 55
 Thallus without an axial row of cells 41
41. Cylindrical branched plant, beset with ovoid bodies, crowned
 with a tuft of hairs and containing branched filaments
 bearing unilocular sporangia *Sporochnus* ...p. 71
 Plant without ovoid sporangia-containing bodies 42
42. Thallus much branched, forming bushy plant from 6-8 inches long;
 unilocular sporangia sunk in the cortical tissue, not protruding
Dictyosiphon ...p. 56
 Thallus hollow; branches opposite or in whorls; cells large;
 surface cells transformed into unilocular sporangia in whorls,
 making transverse bars visible to the naked eye *Striaria*...p. 58
 Thallus at first solid, later hollow; cells of the axis increasing
 in size towards the periphery, but covered externally by
 a single layer of small cells; unilocular sporangia in sori,
 accompanied by groups of club-shaped filaments, forming
 minute dark-coloured warts over the surface *Stilophora* ...p. 70
 Thallus solid, much branched, eventually covered by whorls of
 tufted hairs, from which arise as lateral branches bead-like
 chains of unilocular sporangia *Arthrocladia* ...p. 64

RHODOPHYCEAE

1. Thallus encrusted with calcium 2
 Thallus not encrusted with calcium 5
2. Thallus expanded horizontally, encrusting rock or other algae;
 attached by the whole under surface, or with free margins, or
 attached at one point only; irregular coral-like branches
 without regular constrictions may arise from the horizontal
 portion 3
 Thallus not expanded horizontally, but erect, branched and
 regularly constricted into an articulated thallus *Corallina* ...p. 104

3. Thallus a plate, originally one cell-layer in thickness but becoming several layered (1-5) in places by means of horizontal divisions; cystocarps in raised pustules; tetraspores in conceptacles *Melobesia* ...p. 102
 Thallus a minute plate (2-10 mm. in diameter) of two cell layers; cells of underlying layer elongated in vertical direction, and each capped by a small cell of the upper layer; zonately divided tetraspores in conceptacles with an apical pore ...
Dermatolithon ...p. 102
 Thallus many cells in thickness, sometimes differentiated into distinct strata with cells elongated in various directions ... 4
4. Thallus encrusting or sometimes forming overlapping or even vertically arranged lamellae; tissue showing curved zones in vertical section (see fig. 110 in Hauck, p. 268); tetraspores in special marginal conceptacles with sieve-like apertures ...
Lithophyllum ...p. 103
 Thallus encrusting or forming coral-like growths; tissues in strata, of which the underlying is as in *Lithophyllum*, but the upper strata are composed of cells arranged in regular vertical rows (see fig. 112, Hauck, p. 272); tetraspores in groups superficially placed or only slightly sunk in the thallus ...
Lithothamnion ...p. 103
 Thallus encrusting, of the same organisation as *Lithothamnion*, but with tetraspores in scattered groups deeply embedded in the tissues, conceptacles opening by sieve-like apertures ...
Phymatolithon ...p. 104
5. Minute filamentous algae creeping in or on the walls of animals or other algae, rarely giving off upright free filaments except when reproducing 6
 Minute plants forming extensive plates or stain-like patches on rock or other algae; thallus an expanded basal plate from which arise vertical filaments of uniform height or a solid pseudo-parenchymatous mass 8
 Thallus of various forms but neither encrusting nor endophytic... 10
6. Thallus endozoic in the walls of *Alcyonidium*; monosporangia on short free filaments emerging from the *Alcyonidium* wall
Acrochaetium endozoicum ...p. 78
 Thallus endozoic in *Sertularia*; cruciately divided tetraspores on vertical filaments emerging through the *Sertularia* wall
Rhodochorton membranaceum ...p. 95
 Thallus endophytic in the walls of *Cladophora rupestris*, etc.; tetraspores, often in twos, formed under the surface of the host wall; sometimes emergent *Schmitziella endophloea* ...p. 102
 Thallus endophytic in the walls of various algae, forming a network; reproduction by monospores cut off from cells of the filament; not emergent *Colaconema* ...p. 77
 Thallus endophytic in the walls of Polysiphonic, etc., giving off monospores from emergent branches ... *Acrochaetium* ...p. 77

- Minute filamentous epiphytes of extremely small size forming discs or patches on the surface of other algae, *Flustra*, etc.; reproduction by monospores cut off by a curved wall arising within a thallus cell 7
7. Discs made up of clearly recognisable filaments free from one another at their apices *Erythrocladia* ...p. 77
Discs made up of confluent filaments forming pseudo-parenchyma with an entire margin *Erythropeltis* ...p. 76
8. Free filaments more than quarter inch in length 20
Free filaments less than quarter inch in length 9
9. Thallus with a basal layer from which arise free vertical threads with cruciately divided tetraspores in the course of the filaments *Petrocelis* ...p. 101
Thallus similar to above but with short tapering vertical filaments united into a pseudo-parenchymatous layer, but readily separable under pressure; cruciately divided tetraspores terminal on short filaments interspersed among the rest *Cruoriella* ...p. 101
Thallus completely attached to the substratum, formed of minute cells united into pseudo-parenchyma, not separable under pressure; tetraspores cruciately or zonately divided, in conceptacles buried in the thallus but opening to the surface by a pore *Hildenbrandtia*... p. 102
Thallus with a basal plate from which arise vertical filaments, 12-30 cells long; not readily separable under pressure, giving rise above to sori of cruciately divided tetraspores and paraphyses *Rhododermis*... p. 104
10. Thallus of very fine *unbranched* filaments attached singly to the substratum 11
Thallus of fine *branched* filaments, monosiphonous throughout; with or without a system of irregular delicate filaments clothing the cells of the main axes 12
Thallus of branched filaments, originally *monosiphonous* but becoming polysiphonous by longitudinal division of cells of main axes, or by cortication in various ways so that ultimate branches or apices of main axes alone show the monosiphonous condition 23
Thallus of various forms, cylindrical, compressed or laminate but *not obviously monosiphonous* 34
11. Filaments monosiphonous *Erythrotrichia* ...p. 76
Filaments becoming polysiphonous but with cell groups arranged in bands of greater width than length *Bangia* ...p. 76
12. Cylindrical branched algae, very gelatinous and worm-like; built up of numerous monosiphonous filaments, longitudinally and radially arranged, more or less separable under pressure 36

- Filamentous algae, not gelatinous or vermiform, with branches
all opposite or whorled, or some alternate and some opposite 13
- Filamentous algae, not gelatinous or vermiform, with branches
alternate 19
13. Branches whorled 14
- Branches opposite or occasionally in threes, or main branches
alternate and ultimate branches opposite 16
14. Thallus small, delicate, pinnately divided; main branches in
whorls, sometimes in threes; tetraspores cruciately divided ...
Antithamnion ...p. 98
- Plants 2-6 inches long, densely covered by branches in whorls or
coming off irregularly all round the main axes 15
15. Cells of main filaments very large and uncorticated; whorls of
branches overlapping one another giving a bottle-brush
effect *Halurus* ...p. 94
- Whorls of branches separated from one another, showing main
filament in between; cells of main branches may be corticated
Spondylothamnion ...p. 93
16. Small plants forming dense cushions or tufts of filaments,
quarter to three-eighths inch long; main branches alternate,
ultimate branches opposite; tetraspores singly or in groups on
lateral branches 17
- Plants with definitely pinnate or whorled fronds 18
17. Cells of the filament showing here and there small interpolated
colourless cells *Trailiella* ...p. 93
- Cells of the filament without small colourless cells
Spermothamnion ...p. 93
18. Delicate pinnately divided plants, less than three-quarters inch
long, with tetrahedrally divided tetraspores on the ends of the
pinnules *Ptilothamnion* ...p. 93
- Pinnately divided or whorled plants, three-quarters to two
inches long; cruciately divided tetraspores as lateral
appendages, stalked or sessile *Antithamnion* ...p. 98
19. Plants in small tufts or forming a dense fluffy covering to other
algae or to the substratum (especially where a thin coating of
sand covers the rock); plants half-inch long, or less 20
- Plants three-quarters to 5 inches in length, forming tufts of
branched filaments 21
20. One chromatophore in each cell, usually with a conspicuous
pyrenoid; monospores or (occasionally) cruciately divided
tetraspores *Acrochaetium* ...p. 77
- Several ribbon-shaped or spirally twisted chromatophores in
each cell; cruciately divided tetraspores *Rhodochorton* ...p. 95

21. Plants of conspicuously bright red colour, usually dichotomously branched and uncorticated, growing in stiff tufts, 2-6 inches long; reproductive organs in groups on special branches with short lateral pedicels and surrounded by a whorl of claw-like investing filaments; "cells" of the filaments enormously large... .. *Griffithsia* ...p. 94
 Plant not as above 22
22. Plant 2-4 inches long, uncorticated except for a few rhizoidal filaments at the base of the main axes; large-celled, bearing ovoid monospores (or occasionally tetraspores) on the inner side of clustered branches; cystocarps invested by a whorl of single-celled filaments of large size *Monospora* ...p. 94
 Plant with lateral branches whose proximal half is bare, but pinnately branched in the distal half; tetraspore mother-cells divided up by many radiating walls into a large number of polyspores; cystocarps terminal, surrounded by a whorl of one-celled branches *Pleonosporium* ...p. 94
 Bright red plants, 2-4 inches long, much branched, each branch ending in a hair; tetraspores as lateral branches; but plant more commonly reproduces by chains of ovoid "seiospores," formed by transformation of the cells of terminal dichotomous or trichotomous branches *Seiospora* ...p. 97
 Plant showing branching in one plane; bi-, tri- or quadri-pinnate, with *terminal tetraspores* on ultimate pinnules *Compsothamnion* ...p. 97
 Much-branched plant with tetrahedrally divided tetraspores arising laterally; cystocarps usually in pairs, one on each side of the filament; cystocarps without investing filaments *Callithamnion* ...p. 95
23. Plant fundamentally of a *polysiphonous* axis with a central row of cells, each of which is surrounded by a varying number of pericentral cells of equal length: the polysiphonous axis may be hidden by a mantle of small corticating cells 24
 Plant cylindrical, or dorsiventrally flattened, but fundamentally of a *monosiphonous* axis, partially covered by bands of small cells, or completely enveloped in a sheath of irregular corticating cells 28
24. Plant with polysiphonous main axes but with persistent monosiphonous lateral branches 25
 Plant polysiphonous throughout except for terminal groups of colourless hairs sometimes shed at maturity 27
25. Thallus flattened in one plane *Heterosiphonia* ...p. 93
 Thallus branched in all planes 26
26. Ultimate branches in the form of slender colourless hairs with elongated cells; tetraspores singly in rows in the distal portion of branches *Brongniartella* ...p. 92

- Ultimate branches coloured, stout, curved and pointed; tetraspores arranged in whorls, 5-8 in a whorl on special cylindrical branches with slender pedicels *Dasya* ...p. 92
27. Thallus branched in one plane forming fern-like fronds bi- or tri-pinnately divided; or corticated entirely with the exception of youngest branches, but with polysiphonous main axis discernible *Pterosiphonia* ...p. 92
- Thallus cylindrical, unbranched, polysiphonous but uncorticated except for main axis; frequently beset with groups of colourless hairs at the branch apices ... *Polysiphonia* ...p. 90
- Thallus cylindrical with a group of 5-6 central siphons well covered by a corticating layer several cells thick; branches attenuated at point of insertion; tetraspores embedded in cortex of ultimate branches; antheridia terminal in groups; cystocarps lateral *Chondria* ...p. 89
(See Note 16, p. 116)
- Thallus cylindrical with a few rows of elongated cells in the centre, surrounded by a cortical mantle several cells in thickness (longitudinal section does not show central and pericentral cells of uniform length with their crosswalls in the same planes) *Rhodomela* ...p. 88
(See Note 17, p. 116)
28. Thallus cylindrical 31
Thallus dorsiventrally flattened 29
29. Thallus tough, irregularly pinnately divided, dark in colour or multi-coloured; branches of varying width *Gelidium* ...p. 80
- Thallus rigid, usually stiff enough to maintain its shape when held out of the water; regularly pinnate with alternate long and short branches corticated to their tips ... *Phloea* ...p. 97
- Thallus soft, clinging to the fingers; branches of unequal length, but not regularly long and short; youngest branches monosiphonous *Plumaria* ...p. 97
- Whole plant covered with short spine-like opposite branches lying in one plane; cystocarps terminal on short lateral branches *Bonnemaisonia* ...p. 88
30. Plant cylindrical, branched in one or in all planes, but main axes not flattened 31
- Whole plant covered with short spine-like opposite branches lying in one plane; cystocarps terminal on short lateral branches *Bonnemaisonia* ...p. 88
31. Axial row of cells clearly discernible, either showing through the cortex or giving a "beaded" articulated outline to the plant 32
- Axial row of cells not clearly shown except in very young branches 33

32. Plant cylindrical, branched ; central siphon of very large barrel-shaped or spherical cells, covered only by ring-like bands of small cells or completely corticated, in which case the swollen axial cells give an articulated outline to the plant ; tetraspores in whorls, arising in the cortex *Ceramium* ...p. 98
- Plant cylindrical and branched ; with a definite axial row of large cells, but the outline of the plant is not " beaded " ; axial row of cells covered by a double cortex of larger cells within and very small ones on the periphery ; tetraspores not in whorls *Microcladia* ...p. 100
- Thallus at first with single axial row giving off whorls of much-forked branches ; central axis reinforced later by downwardly-growing filaments. (Distinguishable from *Nemalion* by presence of *whorled* lateral branches) ... *Dudresnaya* ...p. 100
33. Plant cylindrical, branched ; central siphon not clearly shown ; transverse section shows group of 5-8 large cells surrounded by a mantle of smaller cells ; plant closely beset with short branches attenuated at both ends ... *Naccaria* ...p. 79
- Plant cylindrical, branched ; central siphon not clearly shown ; transverse section may show large cell in centre surrounded by large number of others which decrease in size towards the periphery ; cystocarps in flask-shaped receptacles, terminal on short branches ; tetraspores in one or two rows, half immersed in special branches, attenuated at both ends *Rhodomela* ...p. 88
- Plant profusely branched, traversed by single axial thread from which arise whorls of filaments uniting to form a thick cortex of which the outer layer is composed of radially arranged branches of equal length, closely adherent to one another but separable under pressure ; plant may be hollow when old *Gloeosiphonia* ...p. 100
34. Thallus a shapeless brown-purple membrane, without any rigidity ; cells in packets embedded in a colourless matrix ; plant has the texture of a deflated indiarubber balloon ...
- Porphyra* ...p. 76
- Plant a minute parasite entirely buried in the tissues of the host and causing swellings or pustules on its surface, in which the parasite develops reproductive organs 35
- Very gelatinous worm-like algae, built up of longitudinally running filaments from which arise radially arranged cortical filaments held together by mucilaginous material 36
- Algae of various types of organisation 39
35. Parasitic on *Rhodomela subfusca* *Harveyella* ...p. 79
- Parasitic on *Polysiphonia fastigiata* ... *Choreocolax* ...p. 79
- Parasitic on *Phyllophora Brodiaei* or *Gymnogongrus Griffithsiae* *Actinococcus* ...p. 82
- Parasitic on *Ahnfeltia plicata* *Sterrocolax* ...p. 82

36. Thallus at maturity hollow, with inner cortex of longitudinally running filaments, giving off closely set, radially arranged peripheral branches; when young central part traversed by a single axial chain of cells *Gloeosiphonia* ...p. 100
 Thallus never hollow; medulla of longitudinal filaments or large cells, but without a distinct axial row... .. 37
 Thallus at first with a single axial row giving off whorls of much-forked lateral branches; central axis reinforced later by downwardly-growing filaments (distinguishable from *Nemalion* by presence of *whorled* lateral branches) *Dudresnaya* ...p. 100
37. Thallus simple or more or less dichotomously branched; cortex of radiating filaments, separable under pressure and not forming a pseudo-epidermis; cystocarps terminal on short branches not surrounded by special investing filaments
Nemalion ...p. 78
 Thallus dichotomously branched, cylindrical, with a surface layer of colourless cells united into a pseudo-epidermis; embedded cystocarps opening by a pore to the exterior
Scinaia ...p. 79
 Thallus with distinct main axis and lateral branches; cystocarps surrounded by special investing filaments 38
38. Medulla formed of a bundle of attenuated filaments giving off a cortical system of radial branches *Helminthocladia* ...p. 78
 Medulla formed of large cells elongated in the direction of the axis, interwoven by narrow filaments, and covered by groups of radiating branches which, in youth, end in colourless hairs... ..
Helminthora ...p. 78
39. Plant cylindrical, sometimes slightly flattened; with a smooth outline or articulated into separate segments but not expanded distally into narrow blades 50
 Plant with a stem-portion passing gradually into a distally expanded blade 58
 Thallus consisting almost entirely of an expanded lamina, sometimes with veins but without a definite midrib; with or without a short inconspicuous stem 45
 Thallus with stem and leaf-like appendages; or with distinct midrib and lateral laminae; vegetative apex marked by definite apical cell 44
 Thallus expanded into a much branched, *fern-like* frond with narrow segments not more than $\frac{1}{2}$ inch in breadth 40
40. Branches opposite; thallus tri- or quadri-pinnate with very narrow linear segments; a single axial row of cells discernible in the ultimate branches... .. 41
 Branches alternate (opposite or whorled in *I. laurencia obtusa*) ... 42
41. Thallus rigid, usually stiff enough to retain its shape when held out of the water; regularly quadripinnate, with alternate long and short branches corticated to their tips... *Ptilota* ...p. 97

- Thallus soft, clinging to the fingers when lifted out of the water ;
branches of unequal length but not regularly long and short...
Plumaria ...p. 97
- Thallus covered with short spine-like, opposite branches in one
plane ; cystocarps terminal on short lateral branches ...
Bonnemaisonia ...p. 88
42. Thallus with a prominent midrib and a narrow labial wing on
each side, markedly reduced in the axils of branches ...
Delesseria alata ...p. 87
- Thallus not conspicuously differentiated into midrib and lateral
wings 43
43. Small plants with fronds 1-2 inches long, dark in colour ; longi-
tudinal section of younger parts of the fronds shows a central
group of elongated cells *Gelidium* ...p. 80
- Thallus of solid texture, dark red in colour, quarter to half an
inch in width ; several sharply marked teeth on each
pinnule *Odonthalia* ...p. 89
- Thallus with narrow segments, the ultimate ones arising uni-
laterally like the teeth on a comb ; zonately divided tetra-
spores in special marginal clusters of branches *Plocanium* ...p. 86
- Narrow ribbon-like, much divided thallus, beset with numerous
short, lateral appendages sometimes distended into globular
swellings *Sphaerococcus* ...p. 83
- Substantial fronds with blunt-ended lateral branches but not
conspicuously narrow insertions ; transverse section circular
or ovoid in outline *Laurencia* ...p. 89
44. Stem beset with numerous irregularly lobed leaf-like appendages,
each with conspicuous veinings ; main stem and margins of the
frond frequently covered with small irregular emergences
bearing reproductive organs *Phycodrys* ...p. 87
- Stem short, stout and creeping, bearing conspicuous upright
pointed " leaves," 2-5 inches long *Delesseria sanguinea* ...p. 87
- Thallus ribbon-like with a narrow lamina on each side of the
midrib *Delesseria alata* ...p. 87
- Thallus narrow with secondary and tertiary branches springing
from the midribs *Delesseria hypoglossum* or *D. ruscifolia* ...p. 88
45. Thallus $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, consisting of a flattened ovoid frond
from the margins of which spring a few (6-12) similar branches
Lomentaria rosea ...p. 85
- Plant of extreme leatheriness of texture ; bright red in colour,
forming single (or few) spoon-shaped blades, 2-6 inches in
diameter attenuated towards the base *Dilsea* ...p. 100
- Thallus of tough and almost opaque fronds, completely laminate,
usually without a stem-like portion, variously lobed and
frilled, without veins 46
- Thallus expanded into a delicate, usually a transparent mem-
brane ; with or without veins ; variously divided into lobes
or ribbon-like segments ; sometimes frilled at the margins... 47

46. Plant rose-coloured, almost transparent; transverse section shows four rows of cells only, of which the two innermost are rectangular in outline and very large; superficial tissue a single layer of very small cells *Halarachnion* ...p. 101
- Plant dark red in colour, at least at the base, sometimes freely proliferating from the margin; transverse section shows central tissue of large rounded colourless cells; tetraspores cruciately divided *Rhodymenia* ...p. 84
- Large membranous algae of stout texture, usually undivided though sometimes lobed; central tissues of longitudinally elongated and interwoven filaments covered by cortical layers of small cells *Callymenia* ...p. 82
- Thallus bright red, opaque, broad, dichotomously divided, spreading out fan-wise; frequently with proliferations from the margins *Callophyllis* ...p. 82
47. Thallus extremely delicate in texture; the greater part of it one cell only in thickness; variously lobed and divided; sometimes with short irregular veins; apical cell not distinct; tetraspores tetrahedrally divided; cystocarps scattered over the frond *Nitophyllum* ...p. 86
- Thallus several cell layers in thickness 48
48. Large membranous algae of stout texture, undivided or irregularly lobed 49
- Thallus bright-red, opaque, broad, dichotomously divided, spreading out fan-wise; frequently with proliferations from the margins; cystocarps and tetraspores scattered over the thallus or localised on the proliferations *Callophyllis* ...p. 82
- Thallus very delicate in texture, pale in colour, very finely divided into narrow ribbon-like segments, quarter inch in diameter, often toothed; cystocarps large and prominent on the margins of the fronds; tetraspores relegated to the tips of the ultimate branches; longitudinal section shows a medulla built up of dichotomously branched rows of large cells *Euthora* ...p. 83
- Thallus of delicate texture divided into lobes that are frequently dichotomous; growing in almost spherical masses 2-6 inches in diameter; zonate tetraspores mostly on the tips of the fronds; cystocarps scattered along the margins; longitudinal section of the medulla shows a central filament of elongated cells giving off alternate branches *Rhodophyllis* ...p. 83
- Thallus with an elongated lanceolate blade giving off irregularly (sometimes pinnately) marginal tongue-like branches *Calliblepharis* ...p. 84
49. Central tissue of longitudinally elongated and interwoven filaments covered by cortical layers of small cells *Callymenia* ...p. 82
- Central tissues of large rounded colourless cells clearly visible through the superficial layers of small cells *Rhodymenia* ...p. 84

50. Thallus hollow, or stem solid and branches hollow ... 51
 Thallus solid throughout ... 54
51. Thallus, at least the main branches of it, not obviously constricted into articulated joints; branched in one or in all planes ... 52
 Thallus, both main stem and branches, definitely constricted into articulated joints ... 53
52. Thallus branched sparingly at the base, forming clumps of tubular, irregular and sometimes twisted branches, slightly flattened; 3-12 inches in length by $\frac{1}{4}$ to $\frac{1}{2}$ an inch in width; dark purple-red or brownish in colour; built up of longitudinally running threads giving off short peripheral branches and covered by a layer or two of very small branches ... *Dumontia* ...p. 100
 Thallus 2-6 inches long, much branched; finely divided, usually in one plane only, but sometimes in all planes; bi- or tri-pinnate; each pinnule an elongated club-shaped branch, attenuated at both ends ... *Lomentaria clavellosa* ...p. 85
 Thallus $\frac{1}{2}$ to $1\frac{1}{2}$ inches long, consisting of a flattened ovoid frond, from the margins of which spring a small number (6-12) of similar branches ... *Lomentaria rosea* ...p. 85
 Main stem cylindrical, closely beset at or near the apex with distended ovoid branches, on which or in which reproductive organs may occur ... *Chylocladia ovatus* ...p. 86
53. Very small plant, about $\frac{3}{4}$ inch in height; blackish, found in crevices of rock in upper half of littoral zone; thallus not completely hollow but traversed by a wide-meshed network of interlacing filaments; tetraspores zonately divided ... *Catenella* ...p. 83
 Plant 2-4 inches long, clearly and definitely articulated into bead-like joints, but branched more or less in one plane, forming fan-shaped fronds; articulations of main stem about $\frac{1}{4}$ inch in length ... *Lomentaria articulata* ...p. 85
 Plant 5-12 inches long of pyramidal outline; branches arising in whorls of 3-6, secondary and tertiary branches similar; articulations of main stem $\frac{1}{2}$ to $\frac{3}{4}$ inch in length ... *Chylocladia kaliformis* ...p. 85
 Plant 1-4 inches long, forming a dense tuft of spreading branches, whose segments, though definitely articulated, are not conspicuously swollen in their middle region *Champia* ...p. 85
54. Thallus less than 1 inch long, articulated into bead-like joints; black or dark purple in colour ... *Catenella* ...p. 83
 Thallus cylindrical or slightly compressed but not articulated into bead-like joints ... 55
55. Thallus with sturdy cylindrical stems, $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, 3-6 inches long, repeatedly forked; terminal branches slightly swollen, reaching a uniform height and giving a very regular appearance to the plant ... 56

- Thallus irregularly branched, of extreme wiriness; almost black in colour *Ahnfeltia* ...p. 82
- Plant not rigid, cylindrical, purple-red, much branched, forming bushy tufts 4-18 inches long 57
56. Plant attached to the substratum by *branched finger-like "rootlets"*; reproductive organs in swollen terminal branches; tetraspores zonately divided *Furcellaria* ...p. 101
- Plant attached by *compact basal disc*; reproductive organs in wart-like swellings developed laterally on the thallus *Polyides* ...p. 101
- Thallus dichotomously branched in one plane, forming compact tufts 2-4 inches high; tetraspores cruciately divided *Gymnogongrus* ...p. 81
57. Much branched plant with medulla composed of longitudinally elongated filaments; tetraspores *zonately* divided *Cystoclonium* ...p. 82
- Plant with medulla of large colourless cells not elongated as hyphae; tetraspores *cruciately* divided *Gracilaria* ...p. 84
58. Thallus more or less pinnately divided *Laurencia* ...p. 89
- Plant of extreme leatheriness of texture; bright red in colour, forming single (or few) spoon-shaped blades, 2-6 inches in diameter, attenuated towards the base *Dilsea* ...p. 100
- Thallus of tough texture, dark in colour; irregularly pinnate, or lanceolate with strap-shaped or filiform emergences arising on the margins 59
- Thallus more or less perfectly dichotomous 60
59. Small plants with fronds 1-3 inches long, dark in colour; younger parts of the plant in section show a *central group of elongated cells* *Gelidium* ...p. 80
- Thallus consisting of a stalked blade 2-7 inches long with a series of filiform appendages half to three-quarter inch long arising from the margin; tetraspores zonately divided *Calliblepharis* ...p. 84
60. Thallus with medulla of interwoven threads, giving off obliquely ascending filaments, from which arises a cortex of radially arranged filaments; cruciately divided tetraspores *not in nemathecia* 61
- Thallus with a medulla of large, loosely packed cells and small-celled cortex; *tetraspores in nemathecia* *Phyllophora* ...p. 81
61. Thallus dichotomously branched, very variable in width and in texture, spreading out into fan-like expansions; cystocarps embedded in the frond *Chondrus* ...p. 80
- Thallus not dichotomously branched; tips of the fronds expanded somewhat suddenly into more or less triangular blades; cystocarps in special papillate emergences arising from the distal expanded portions of the thallus, more numerous on one side than the other *Gigartina* ...p. 81

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EXPLANATION OF PLATES

PLATE I.

View of the limestone terraces, Port St. Mary, looking south. Saucer shaped "coralline" pools in foreground.

PLATE II.

Photograph of a pool taken from above. The limestone surface shews embedded fossils, and the vegetation consists of discs of *Ralfsia verrucosa* (dark, with faint light lines) and small plants of *Lithothamnion Lenormandi* (white).

PLATE III.

Inter-pool vegetation about mid-tide zone on the limestone terraces, Port St. Mary. The rock surface is encrusted with *Lithothamnion Lenormandi* which is beset with stunted plants of *Corallina officinalis*. The upper storey of vegetation consists of *Laurencia hybrida*.

PLATE IV.

A pool at low tide zone, Pooyllvaish, shewing *Laminaria digitata* and *Fucus serratus* with a scattered growth of *Ascophyllum nodosum* on the higher rocks.

PLATE V.

Inter-pool vegetation on the limestone terraces, Port St. Mary. Colonies of *Himanthalia lorea* in all stages of growth are shewn. The undergrowth consists of a basal layer of *Lithothamnion Lenormandi* bearing distorted plants of *Corallina officinalis*, both of which are covered by *Laurencia hybrida*.

PLATE VI.

A pool from just above mid-tide zone on the limestone terraces, Port St. Mary, shewing the condition of the pool in April. *Lithothamnion Lenormandi* makes a continuous carpet over the rock surface. *Corallina officinalis* fringes the edge and a mixed vegetation in young stages of development crowns conspicuous "limpet-islands."

PLATE VII.

A pool from mid-tide zone on the limestone terraces, Port St. Mary. The floor of the pool is completely covered with *Lithothamnion Lenormandi* and the margin shews *Corallina officinalis*. The photograph was taken in April when representatives of other genera (*Ulva*, *Scytosiphon*) were just making their appearance as epiphytes on the *Corallina*.

PLATE VIII.

- Fig. 1. Part of a filament of *Ectocarpus tomentosoides* shewing uniseriate plurilocular sporangia. $\times 400$.
 Fig. 2. Plurilocular sporangium and part of the filament shewing cell-organisation in *Ectocarpus tomentosoides*. $\times 800$.
 Fig. 3. Cell-organisation of *Ectocarpus confervoides*. $\times 1500$.

- Fig. 4. Filaments shewing plurilocular sporangia and method of branching in *Ectocarpus confervoides*. $\times 240$.
 Fig. 5. Part of a plant of *Ectocarpus fasciculatus* var. *refracta* with plurilocular sporangia. $\times 240$.
 Fig. 6. Cell-organisation of *Ectocarpus fasciculatus*. $\times 2000$.

PLATE IX.

- Fig. 7. A section of a young plant of *Ulonema rhizophorum* from the thallus of *Rhodymenia palmata*. $\times 800$.
 Fig. 8. Cell-organisation of *Ectocarpus simplex*. $\times 1500$.
 Fig. 9. The distal end of a filament of *Ectocarpus simplex* shewing attenuation when compared with Figs. 11 and 12. $\times 240$.
 Fig. 10. Surface view of margin of disc of young plant of *Ulonema rhizophorum*. $\times 800$.
 Fig. 11. Filament of *Ectocarpus simplex* with plurilocular sporangia. $\times 240$.
 Fig. 12. *Ectocarpus simplex* with unilocular sporangia. $\times 240$.
 Fig. 13. Part of a plant of *Ulonema rhizophorum* shewing unilocular sporangia, paraphyses, rhizoids and part of a mucilage hair. $\times 1500$.

PLATE X.

- Fig. 14. *Ectocarpus terminalis* from the surface of a limpet shell, shewing "innovation" of unilocular sporangia. $\times 360$.
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 Fig. 16. Part of a filament of *Ectocarpus tomentosus* with plurilocular sporangia. $\times 480$.
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 Fig. 18. Part of the filament of *Isthmoplea sphaerophora* with unilocular sporangia. $\times 240$.

PLATE XI

- Fig. 19. Filaments of *Ectocarpus luteolus* with plurilocular sporangia, from surface of stem of an old frond of *Fucus serratus*. $\times 240$.
 Fig. 20. Cell-organisation of *Ectocarpus luteolus*. $\times 1000$.
 Fig. 21. Cell-organisation of *Myriotrichia filiformis*. $\times 1000$.
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 Fig. 25. Part of a plant of *Ectocarpus fasciculatus* forma *typica* with plurilocular sporangia. $\times 240$.

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- Fig. 26. Part of a plant of *Ascocyclus saccharinae* from the frond of *Laminaria saccharina* with ascocysts, depleted plurilocular sporangia and assimilatory filaments. $\times 1500$.
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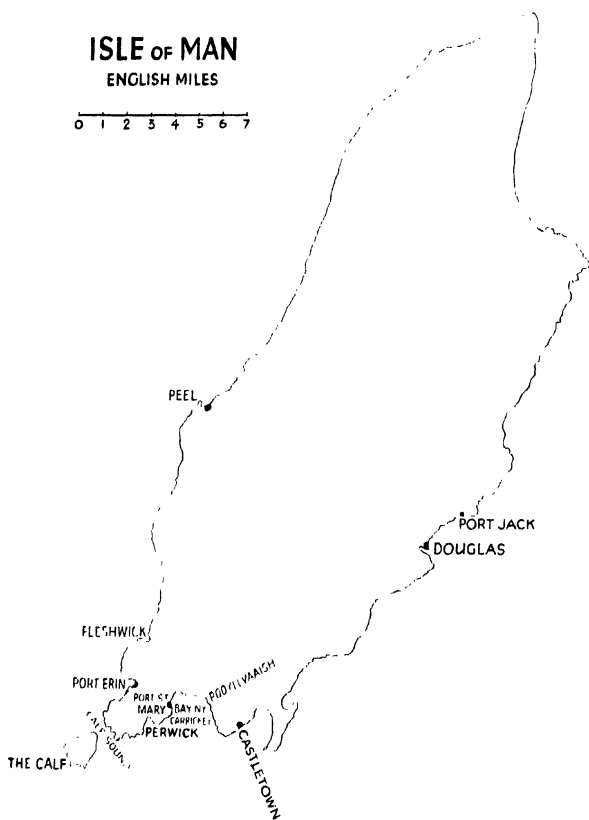
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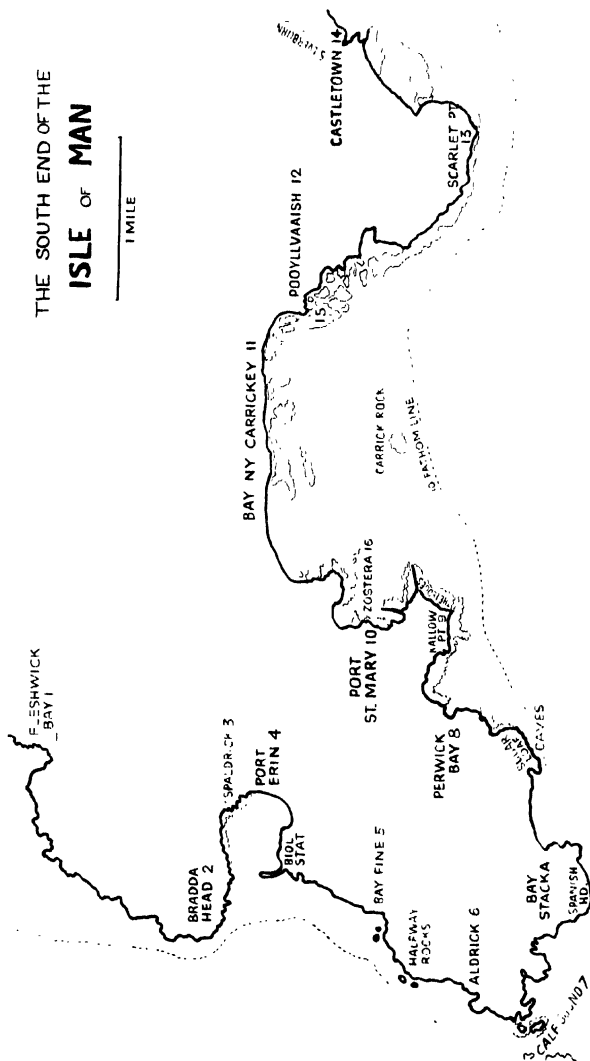
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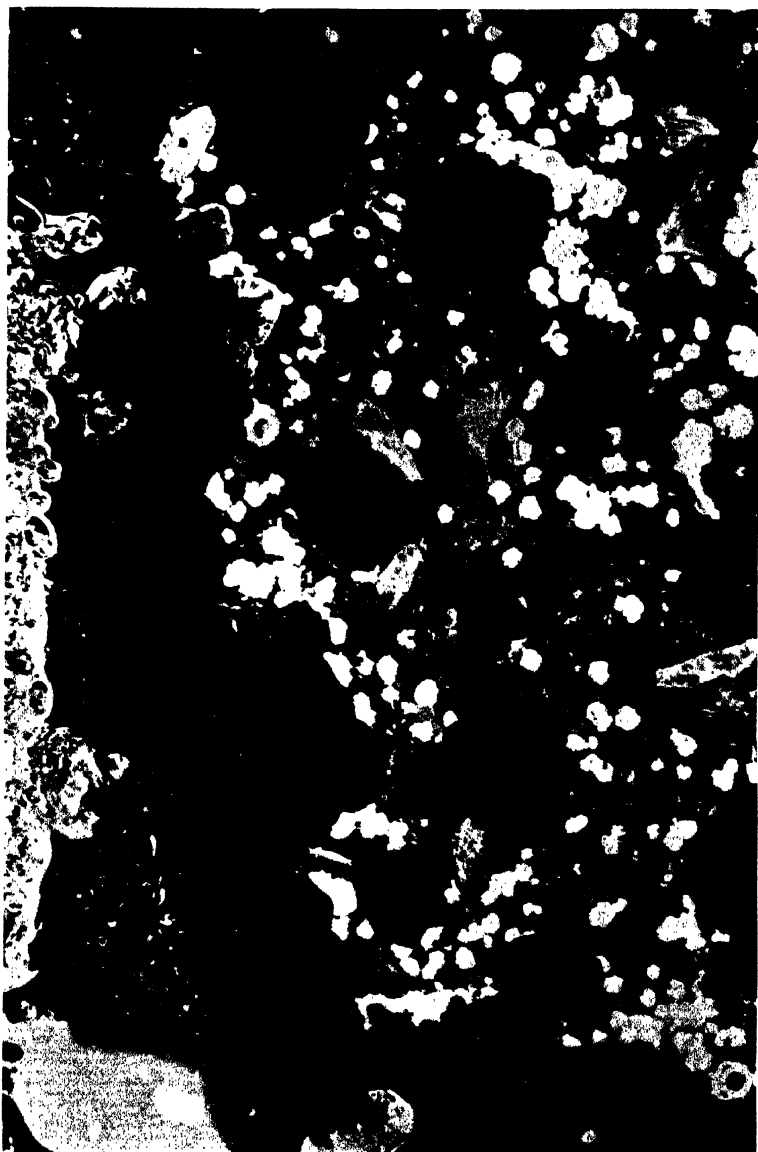
- Spondylothamnion, 93, 132.
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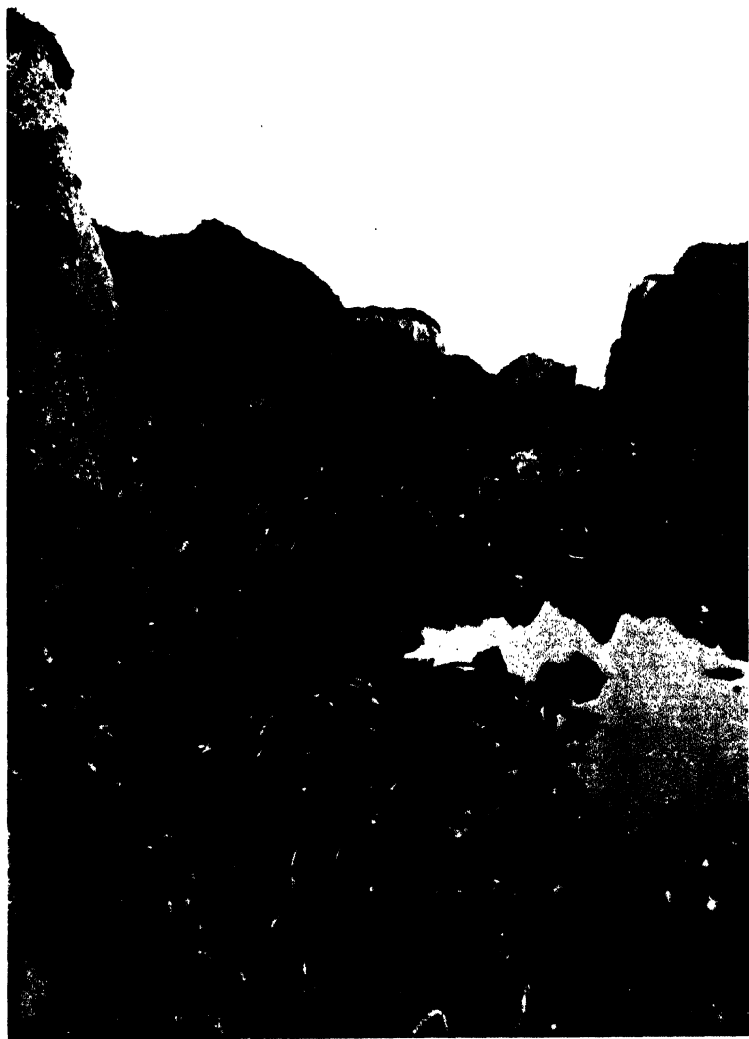
The limestone terraces at Port St. Mary. Saucer-shaped pools shewing in the foreground.



The Ledges, Port St. Mary. Pools from the upper level of the littoral zone shewing *Ralfsia verrucosa* and *Lithothamnion*.



The mid-tide zone of the limestone terraces at Port St. Mary. Inter-pool vegetation with *Laurencia hybrida* dominant.



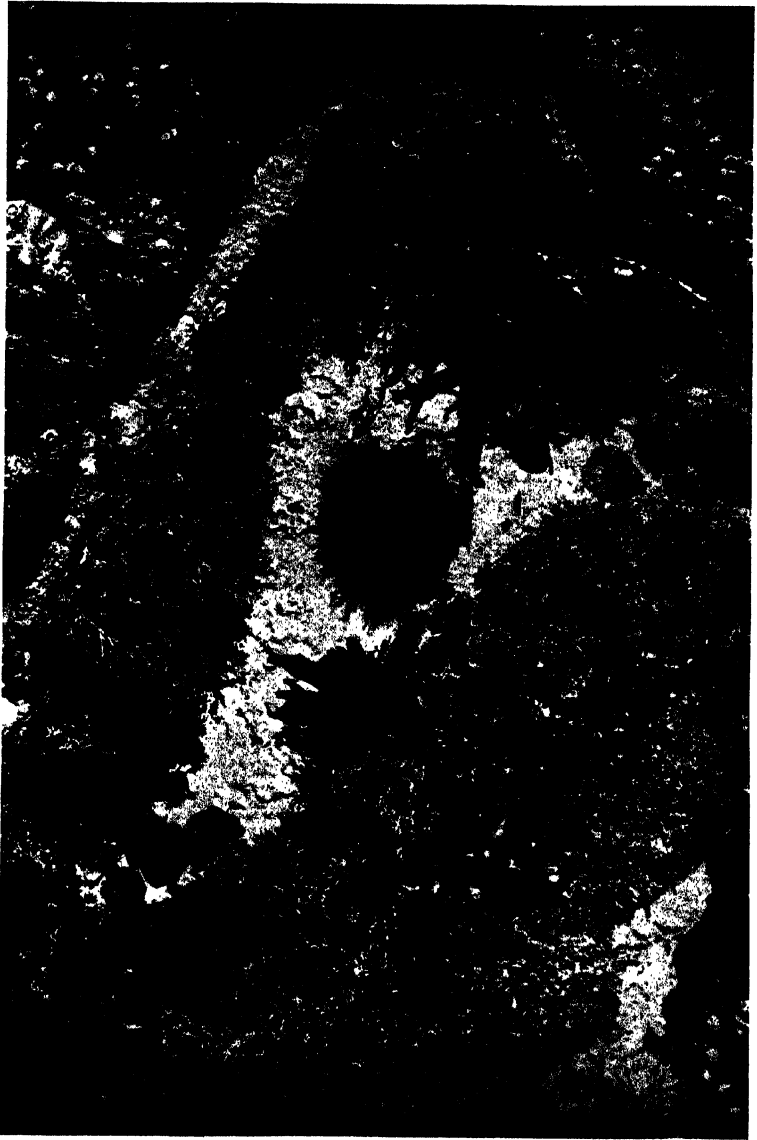
Low water of spring tides shewing *Laminaria digitata* and *Fucus serratus* association. Pooyllvaaish.



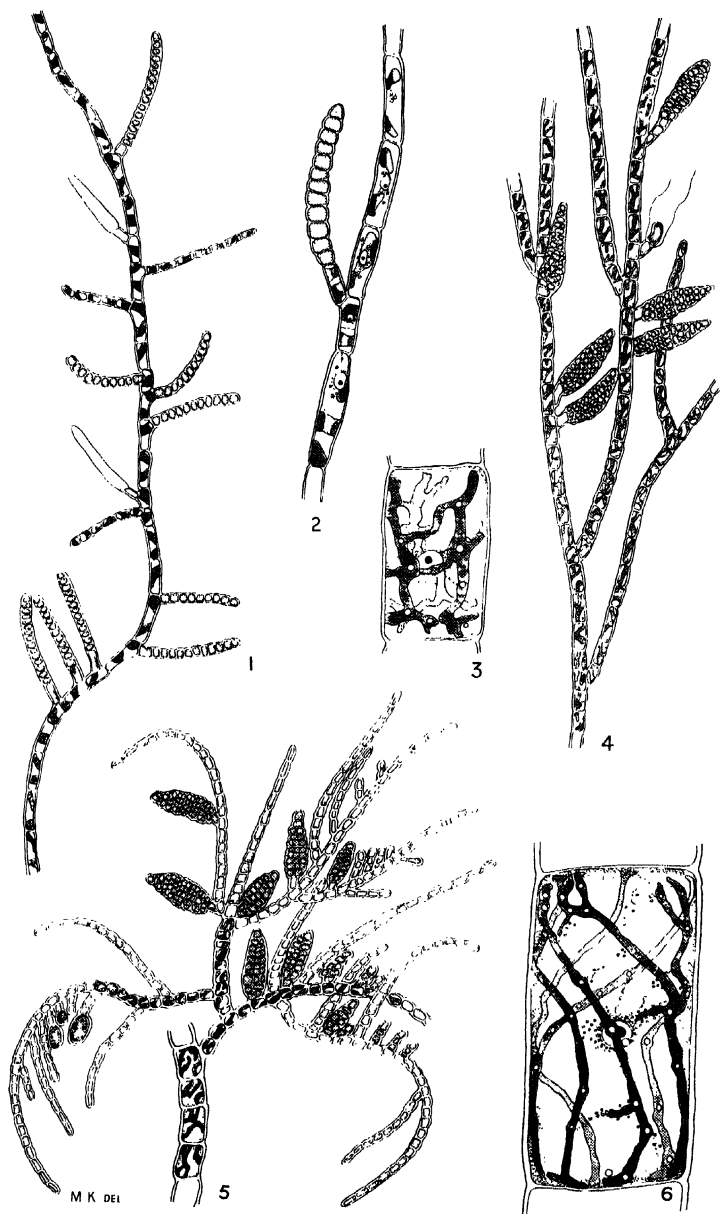
Himanthalia lorea in various stages of development on The Ledges,
Port St. Mary.



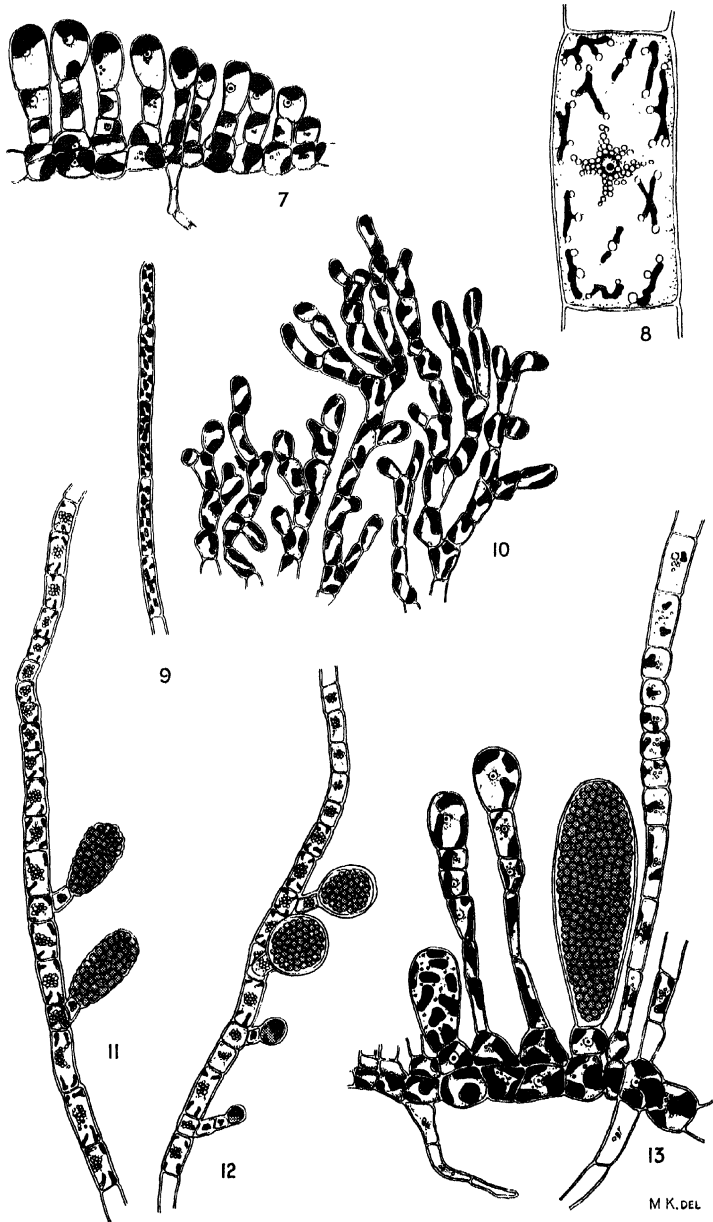
Photograph of the floor of a pool covered by *Lithophyllum Lenormandi*.
Half natural size.



Small pool on The Ledges, Port St. Mary. Quarter natural size, shewing *Lithophyllum Lenormandi*, *Corallina officinalis* with epiphytes. Limpet with *Ectocarpus* in centre.

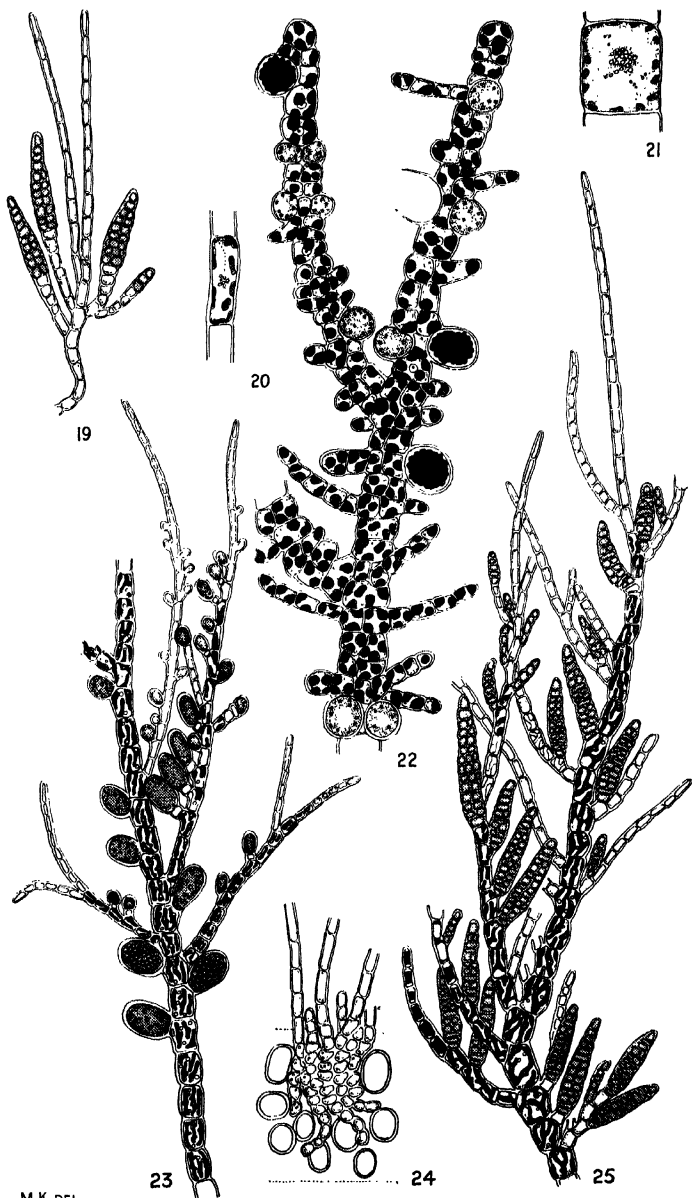


1, 2. *Ectocarpus tomentosoides*.
 3, 4. *Ectocarpus confervoides*.
 5, 6. *Ectocarpus fasciculatus* var. *refracta*.



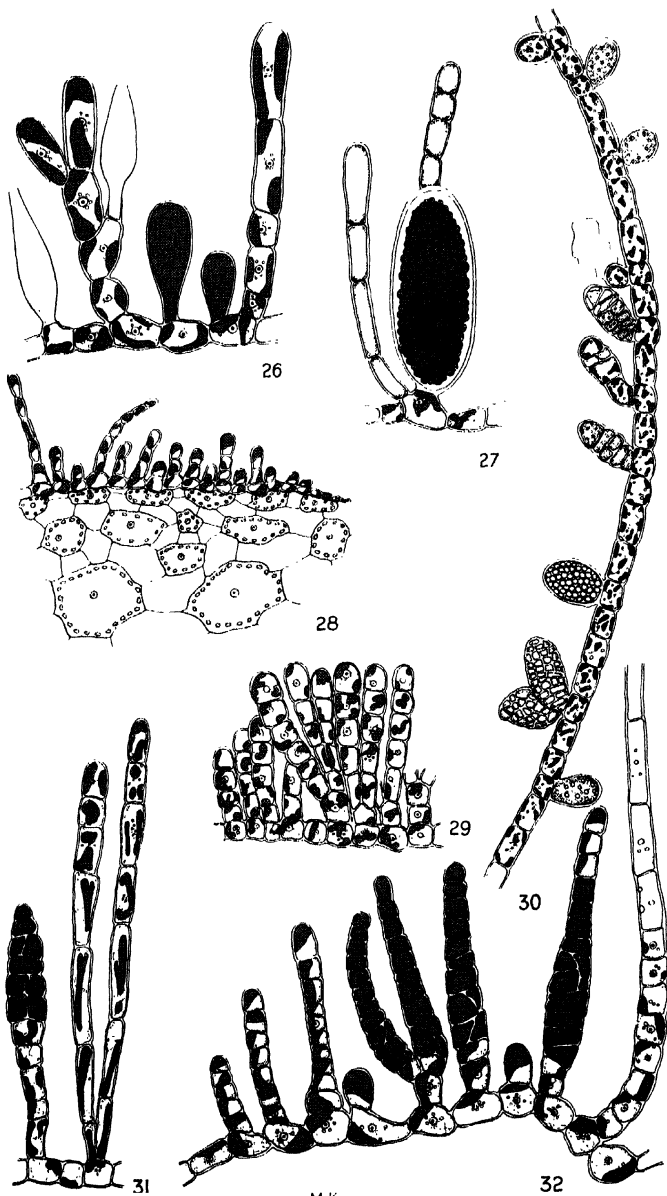
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7, 10, 13. *Ulonema rhizophorum*.
8, 9, 11, 12. *Ectocarpus simplex*.



M.K. DEL

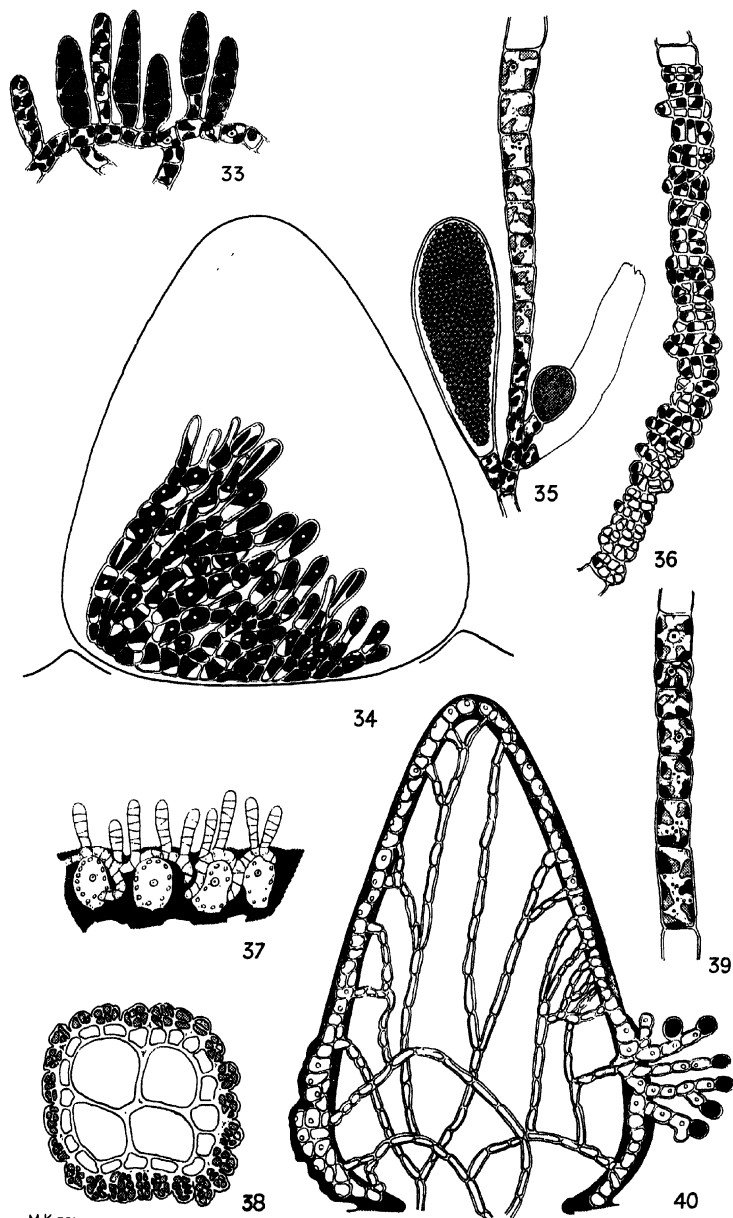
19, 20, 24. *Ectocarpus luteolus*. 21, 22. *Myriotrichia filiformis*.
23, 25. *Ectocarpus fasciculatus*.



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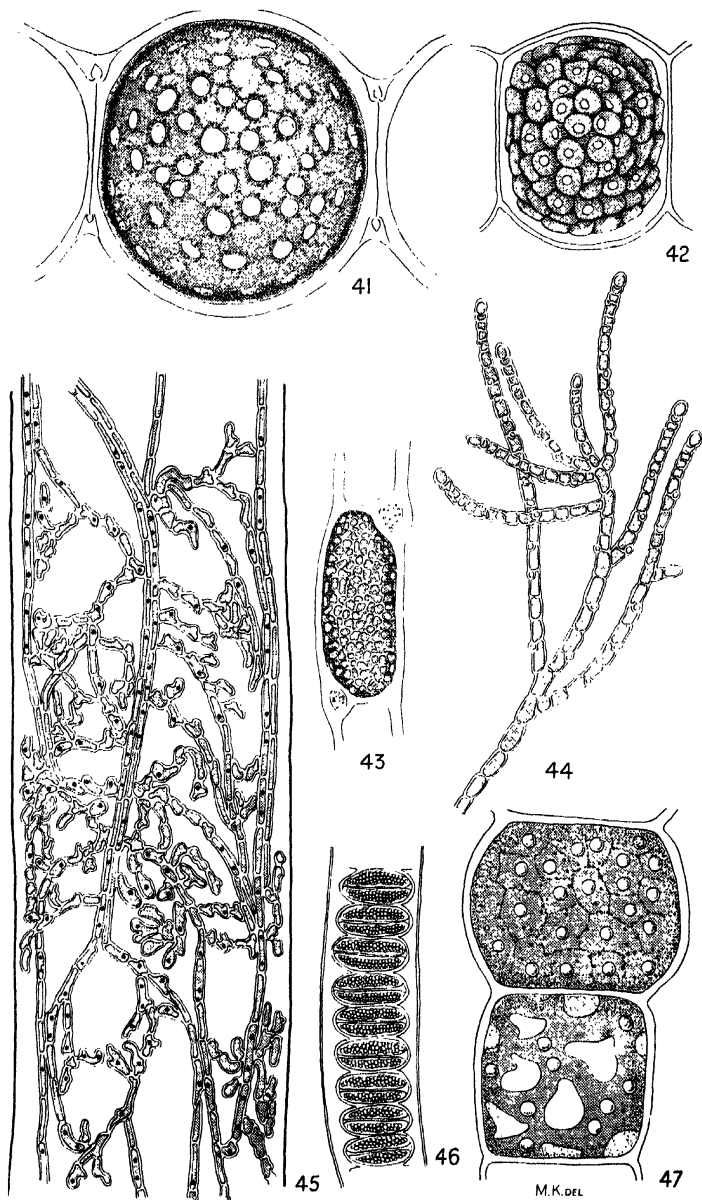
26, 31. *Ascocyclus saccharinae*.
27, 29. *Myrionema saxicola*.

28, 32. *Streblonema Zanardinii*.
30. *Ectocarpus ovatus*.



33, 37. *Streblonema parasitica*.
35, 36, 39. *Leptonema fasciculatus*.

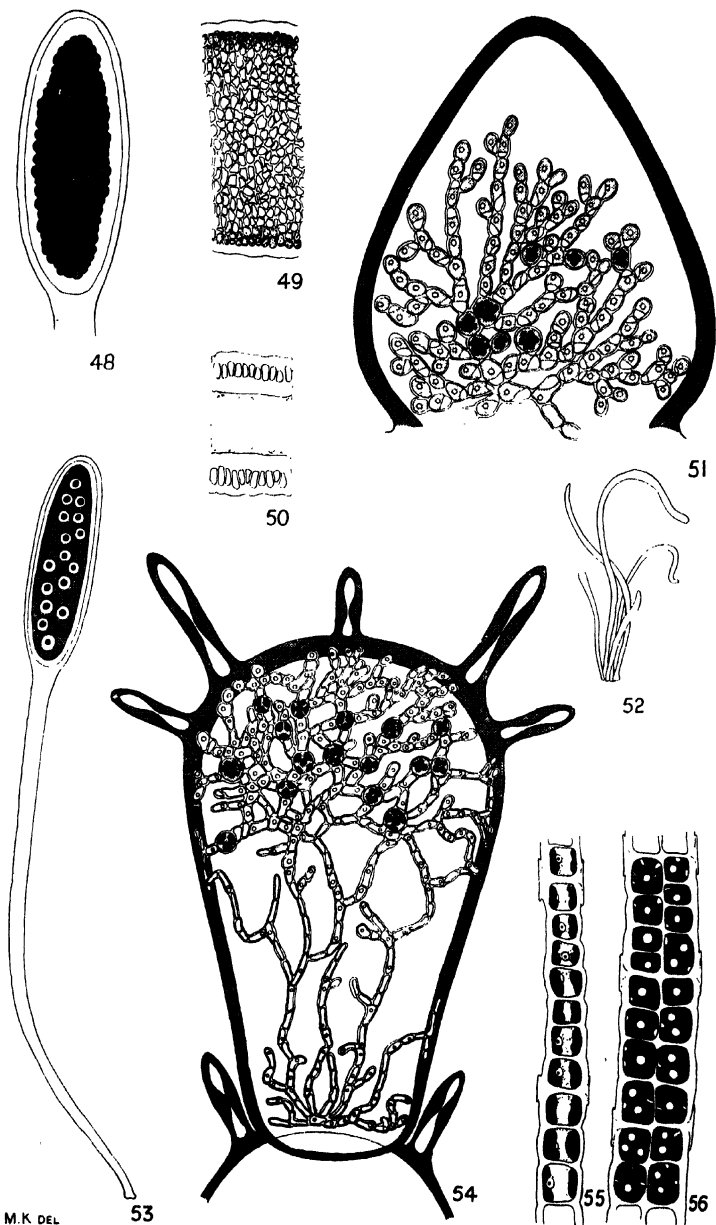
38. *Stictyosiphon tortilis*.
34, 40. *Acrochaetium endozoicum*.



41. *Urospora collabens*.
42, 47. *Urospora mirabilis*.
43, 44. *Trailiella intricata*.

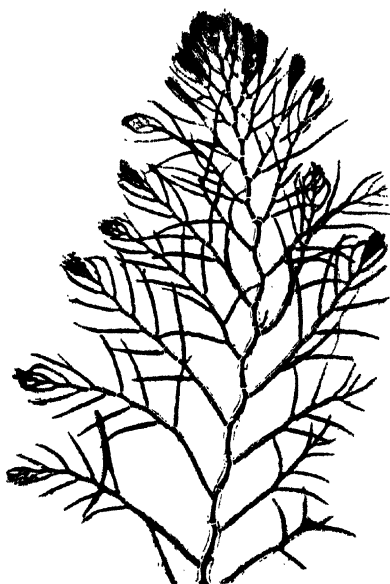
45. *Colaonema reticulata*.
46. *Urospora bangioides*.

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48, 53. *Codiolum gregarium*.
59, 50, 52. *Enteromorpha micrococca*.

51. *Endoderma flustrae* var. *Phillipsii*.
54. *Endoderma flustrae*.



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57. *Callithamnion scopulorum*.
58. *Choreocolax Polysiphoniae*.
59. *Prasiola stipitata*.

60. *Callithamnion Dudesnayi*.
61. *Aglaozonia reptans*.



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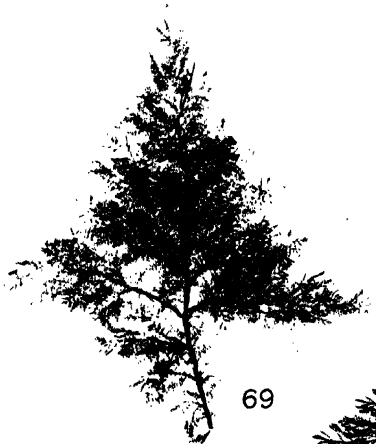


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M.P. PHOTO.

62. *Callithamnion scopulorum*.
 63. *Spondylothamnion multifidum*.
 64. *Callithamnion polyspermum*.
 65. *Callithamnion dudresnayi*.

66. *Antithamnion cruciatum*.
 67. Intergrade between *C. hookeri*
 and *C. polyspermum*.
 68. *Callithamnion arbuscula*.



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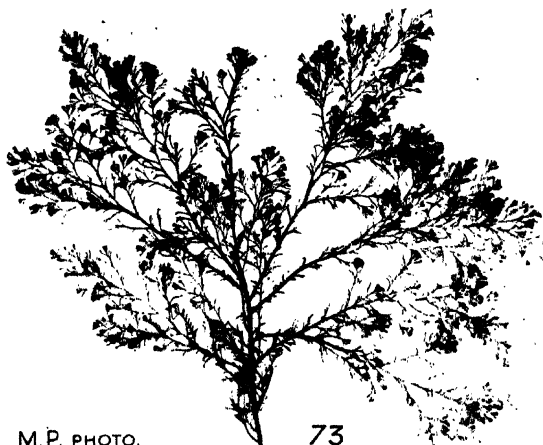
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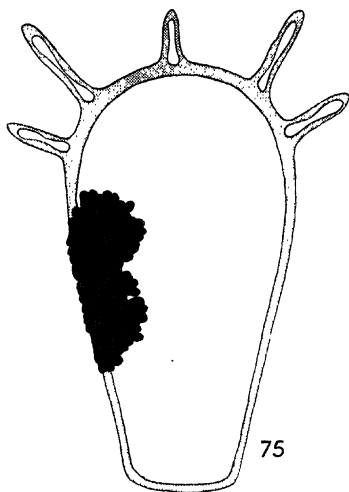


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M. P. PHOTO.

- 69, 70. Intergrades between *Callithamnion*
Hookeri and *C. polyspermum*.
 71. *Nitophyllum uncinatum*.

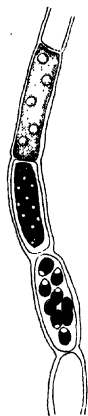
72. *Pleonosporium Borreri*.
 73. *Callithamnion corymbosum*.
 74. *Callithamnion brachiatum*.



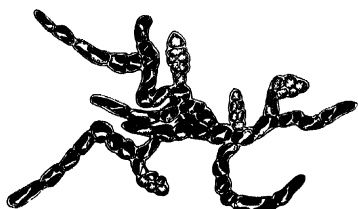
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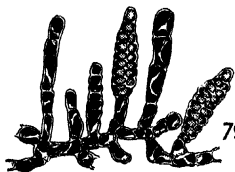
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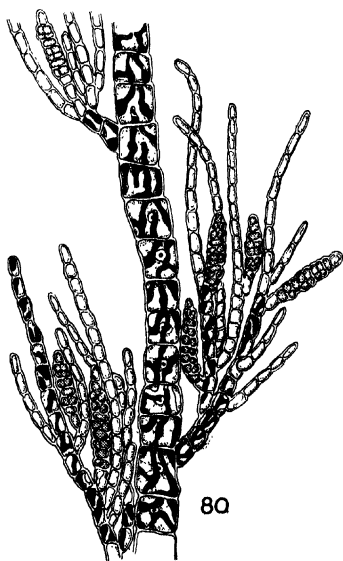
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- 75, 76. *Erythropeltis discigera*.
77. *Rhizoclonium Kernerii*.
78. *Streblonema infestans*.

79. *Ectocarpus brevis*.
80. *Ectocarpus fasciculatus* var.
Draparnaldioides.

